POLLUTION SOURCES INVENTORY

SOURCES OF WATER POLLUTION

Water pollution can be caused by point-sources 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.

In 2004, the Department of Environment recorded 17,991 water pollution point sources comprising mainly sewage treatment plants (8,414: 54%), manufacturing industries (8,203: 38%), animal farms (904: 5%) and agro-based industries (470: 3%) (Figure 24).

Figure 25 represents the distribution of industrial water pollution sources from agro-based and manufacturing industries compiled by the Department of Environment (DOE) in 2004 through field surveys and returned questionnaires. A total of 6,916 sources were identified

Photo 17: Improper Storage of Toxic Wastes in Drums (DOE Photo Library)

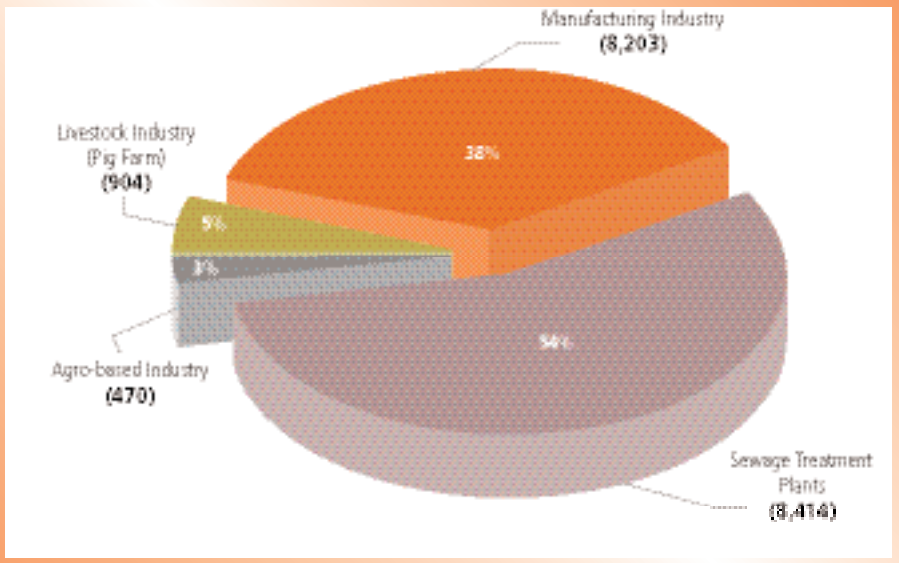

Figure 24 Malaysia: Composition of Water Pollution Sources by Sector, 2004

Statistics by the Veterinary Department of Malaysia shows that the total standing pig population for 2004 was about 1.5 million, a decrease of 11.8% from 1.7 million in 2003. Correspondingly, the number of pig farms in 2004 decreased to 904 farms compared to 950 farms in the previous year.

Meanwhile, the number of sewage treatment plants under the management of Indah Water Konsortium Sdn. Bhd. has increased to 8,414 in 2004 as compared to 7,519 plants in 2003. Selangor had the largest number of sewage

Photo 18: Oil and Grease Contamination of Inland Water (DOE Photo Library)

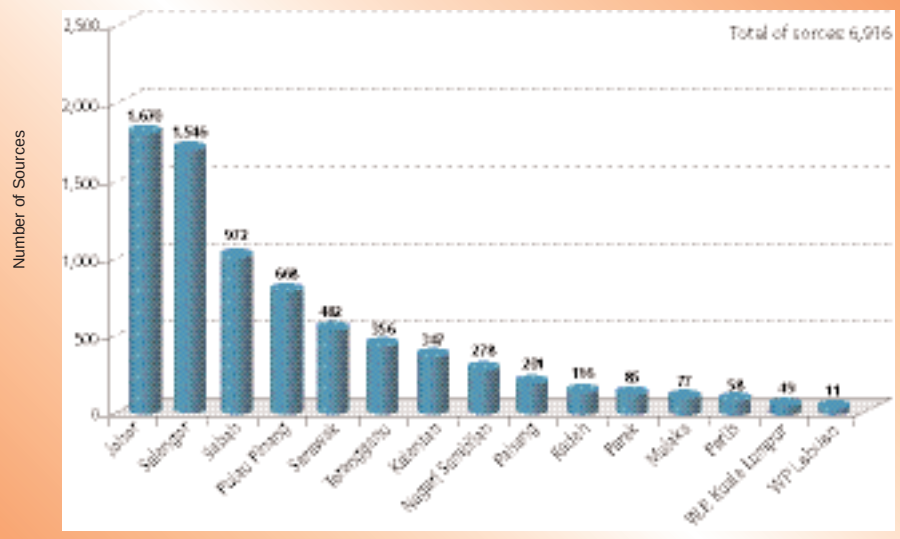

Figure 25 Malaysia: Distribution of Industrial Water Pollution Sources

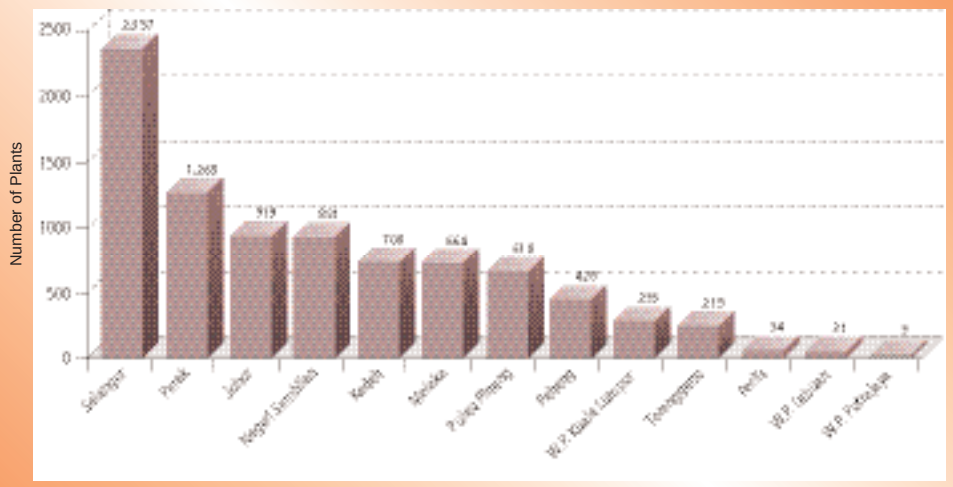

Figure 26 Malaysia: Distribution of Sewage Treatment Plants by State, 2004

treatment plants (2,357: 28.0%), followed by Perak (1,265: 15.0%), Johor (919: 10.9%) and Negeri Sembilan (881: 10.5%) (Figure 26).

BOD POLLUTION LOAD

Domestic sewage discharge, in the form of treated and partially treated sewage, remained the largest contributor of organic pollution load with an estimated biochemical oxygen demand (BOD) load of 927,744.59 kg/day. The estimated BOD loading contributed by other major sectors were agro-based and manufacturing industries (21,616.428 kg/day) and pig farming (197,537.1 kg/day). Table 12 indicates the total BOD load in kg/day discharged

Table12 Malaysia: Total BOD Load (kg/day) from Sewage Treatment Plants of Respective States

State	No. of STP's	Total PE	Flow (m^3/d)	BOD Load (kg/day)
Johor	919	1,139,639	256,419	64,104.69
Kedah	700	489,144	110,057	27,514.35
Melaka	664	502,417	113,044	28,260.96
Negeri Sembilan	881	923,381	207,761	51,940.18
Pahang	428	274,937	61,861	15,465.21
Perak	1265	1,250,072	281,266	70,316.55
Perlis	34	15,296	3,442	860.40
Pulau Pinang	618	2,698,312	607,120	151,780.05
Selangor	2357	6,143,734	1,382,340	345,585.04
Terengganu	215	72,952	16,414	4,103.55
WP Kuala Lumpur	293	2,809,277	632,087	158,021.83
WP Labuan	31	53,272	11,986	2,996.55
WP Putrajaya	9	120,804	27,181	6,795.23
Total	**8,414**	**16,493,237**	**3,710,978**	**927,744.59**

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

AIR POLLUTION SOURCES AND EMISSION LOAD

The main sources of air pollution in Malaysia can be classified under four main categories as follows:

- Mobile Sources
- Stationary Sources
- Open burning Sources
- Trans-boundary Pollution Sources

Emission from mobile and stationary sources and open burning activities remained the most significant contributors to air pollution load in the country in 2004. In addition, the situation was further aggravated by trans-boundary pollution of fine particles from external biomass burning activities.

Air Pollution from Stationary Sources

Stationary sources comprise emission from industrial sectors including power generation stations. The total number of stationary air pollution sources identified

Photo 19: Aerial View of Agricultural Open Burning (DOE Photo Library)

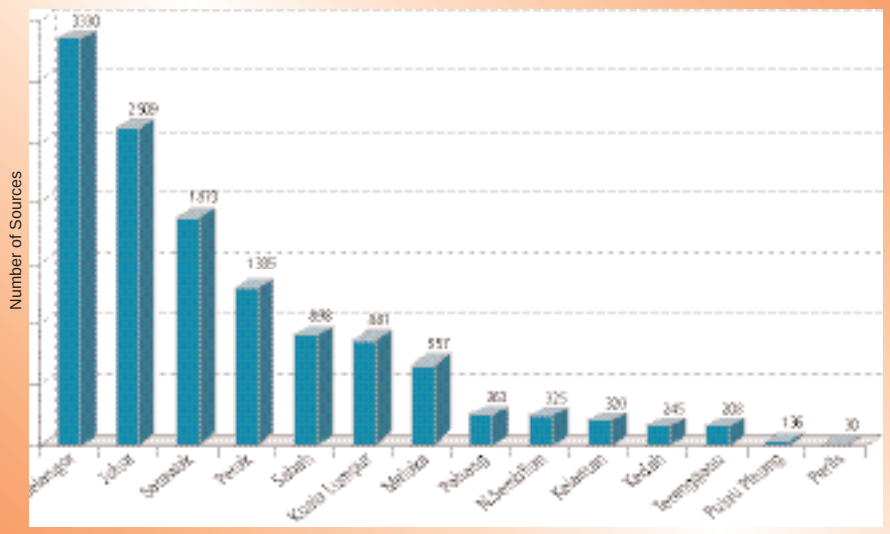

Figure 27 Malaysia: Distribution of Industrial Air Pollution Sources by State, 2004

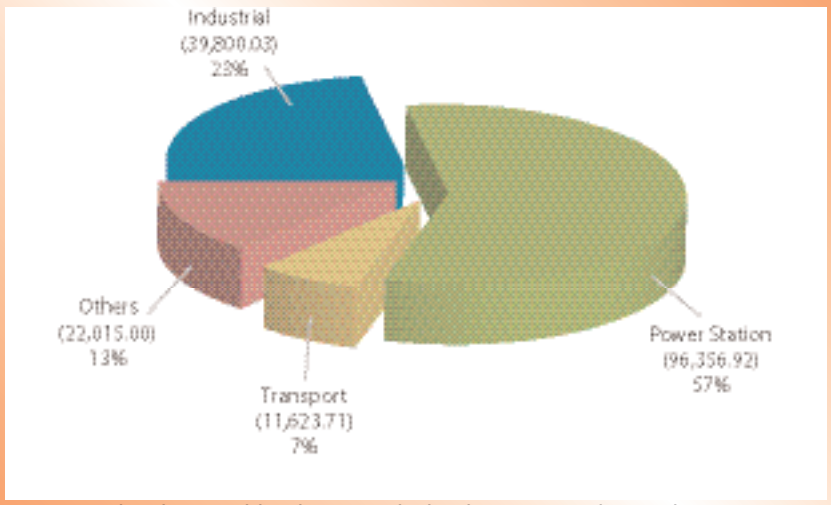

Figure 28 Malaysia: Combined SO_2 Emission by Sources (tonnes), 2004

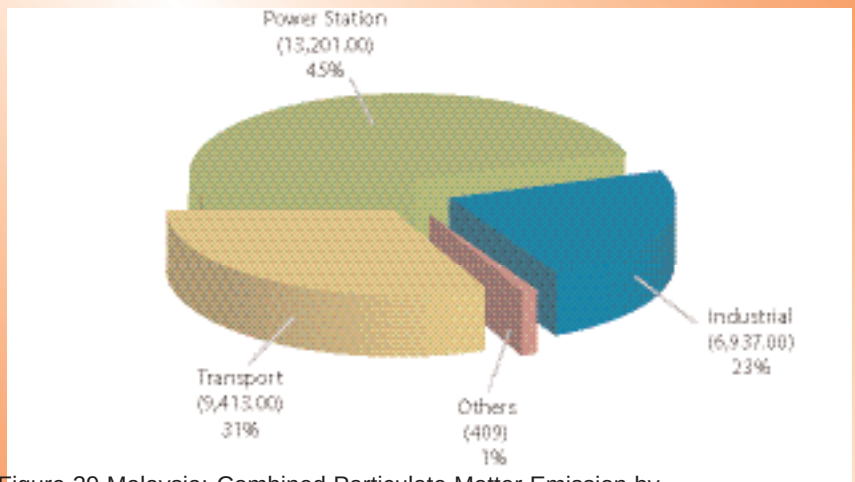

Figure 29 Malaysia: Combined Particulate Matter Emission by Sources (tonnes), 2004

Emission Load from Stationary Sources

The estimated combined air emission load for 2004 was about 1,280,163 metric tonnes of carbon monoxide (CO); 308,403 metric tonnes of oxides of nitrogen (NO_x); 169,796 metric tonnes of sulphur dioxide (SO_2); and 29,978.0 metric tonnes of particulate matter. Stationary sources, which include industrial sectors and power stations, were the main contributors to the total SO_2 emission load (80%) and particulate matter emission load (68%) (Figure 28, 29), while mobile sources were the main contributors to the NO_x (59%) and CO (98%) emission load (Figure 30, 31). Compared to 2003, there was appreciable reduction

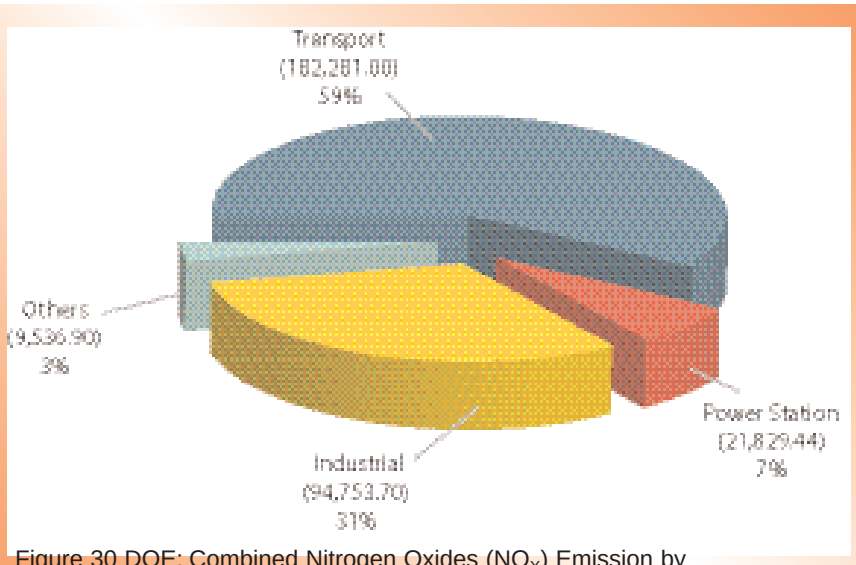

Figure 30 DOE: Combined Nitrogen Oxides (NO_X) Emission by Sources (tonnes), 2004

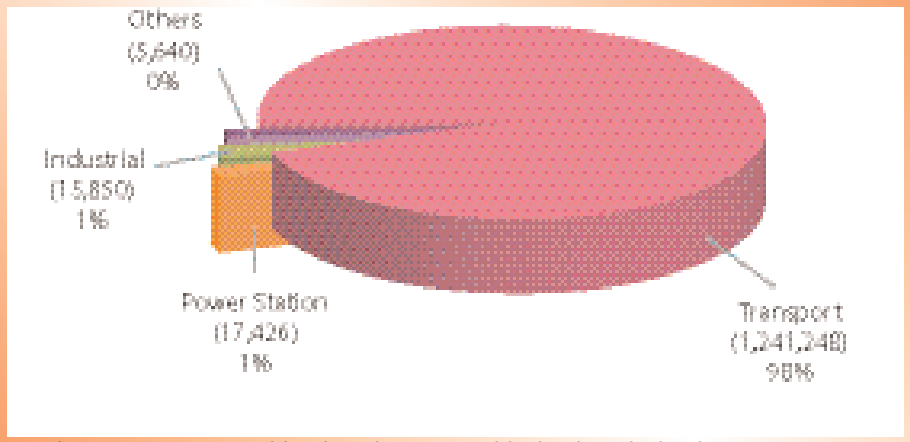

Figure 31 DOE: Combined Carbon Monoxide (CO) Emission by Sources (tonnes), 2004

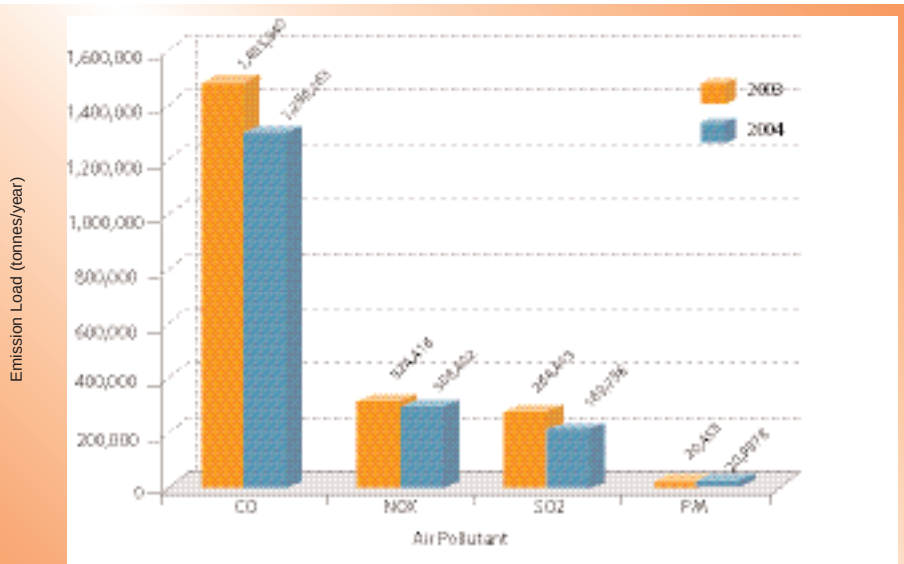

Figure 32 DOE: Air Pollutant Emission Load from Stationary Sources, 2003- 2004

Air Pollution from Mobile Sources

Mobile sources include passenger cars, taxis, buses, motorcycles, vans and lorries are the main contributors to air pollution especially in major cities. The number of registered vehicles in Malaysia for 2003 and 2004 is shown in Figure 33. In 2004, the number of registered passenger cars increased by 8.17%, motorcycles by 6.20%, buses by 3.91%, goods vehicles by 4.11% and taxis by 6.59% compared to 2003. However, the number of in-use vehicles or active vehicles was reduced slightly in 2004 as compared to 2003 except for passenger cars. Figure 34 shows the number of in-use vehicles recorded by the Road Transport Department (RTD) in 2004. The number of in-use or active vehicles was determined through annual road tax renewal. Vehicles that do not

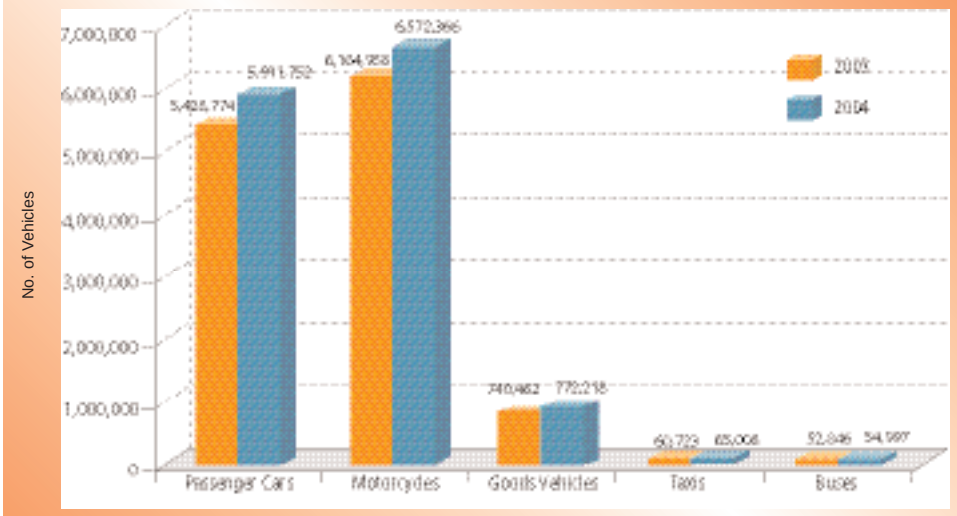

Figure 33 Malaysia: Number of Registered Vehicles, 2003-2004
*Source: Road Transport Department, Malaysia, 2004

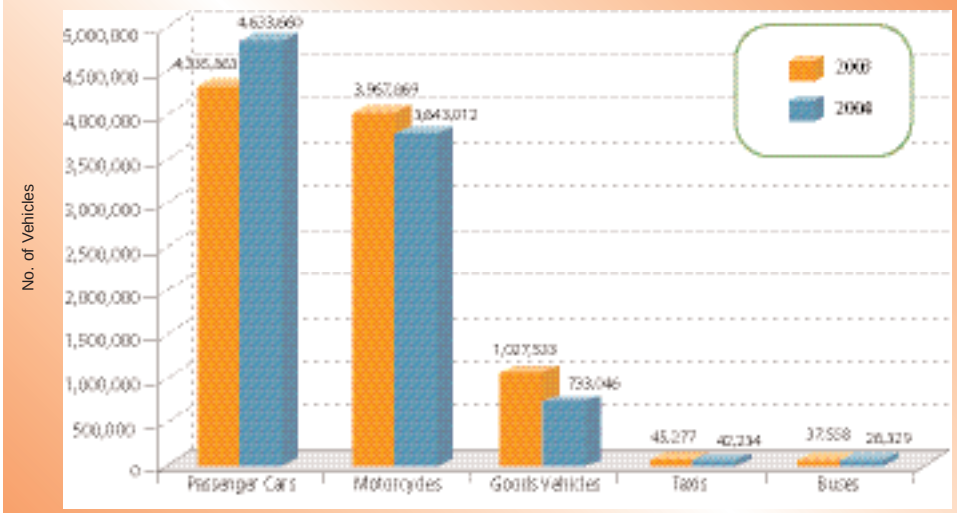

Figure 34 Malaysia: Number of In-Use Vehicles, 2003- 2004
*Source: Road Transport Department, Malaysia, 2004

Photo 20: Urban Air Pollution From Mobile Sources (DOE Photo Library)

Emission Load from Mobile Sources

The estimated annual air pollutant emission load of pollutants, namely hydrocarbon (HC), carbon monoxide (CO), particulate matters (PM_{10}), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) from mobile sources for 2003 and 2004 is as shown in Figure 35. There was an overall decrease in emission load from mobile sources in 2004 due to the decreased number of in-use vehicles on the road. In 2004, the emission load of HC and CO was estimated at 256,874 metric tonnes/year and 1,241,249 metric tonnes/year respectively, representing a decrease of 9.3% in HC emission load and 8.4% in CO emission load as compared to 2003. A decreasing trend was also observed in the emission load of PM_{10}, SO_2 and NO_2 in 2004. Emission load of PM_{10} was 4,174 metric tonnes in 2004 as compared to 7,266 metric tonnes in 2003 (42.6% decrease), SO_2 was 11,624 metric tonnes in 2004 as compared to 16,984 metric tonnes in 2003 (31.6% decrease) and NO_2 was 182,282 metric tonnes as compared to 269,963 tonnes in 2003 (32.5% decrease).

Figures 36 to 40 show the contribution to the respective air pollutant emission load by various categories of vehicles. Vans and lorries were the highest contributors to PM_{10}, NO_2, SO_2 and CO emission loads, while motorcycles contributed the highest emission load for HC.

Figure 36 indicates that 62.4% of PM_{10} emission load was contributed by vans and lorries, 33.4% from buses and the remaining 3.9% from taxis. It was estimated that 55.9% of NO_2 emission load was contributed by vans and lorries, 21.1% by buses, 19.5% by passenger cars and 3.5% by both motorcycles and taxis (Figure 37).

Of the total emission of SO_2, it was estimated that 53.7% was from vans and lorries, 20% from buses, 19.6% from passenger cars, 4.2% from motorcycles and 2.6% from taxis (Figure 38).

Figure 39 illustrates that motorcycles con-

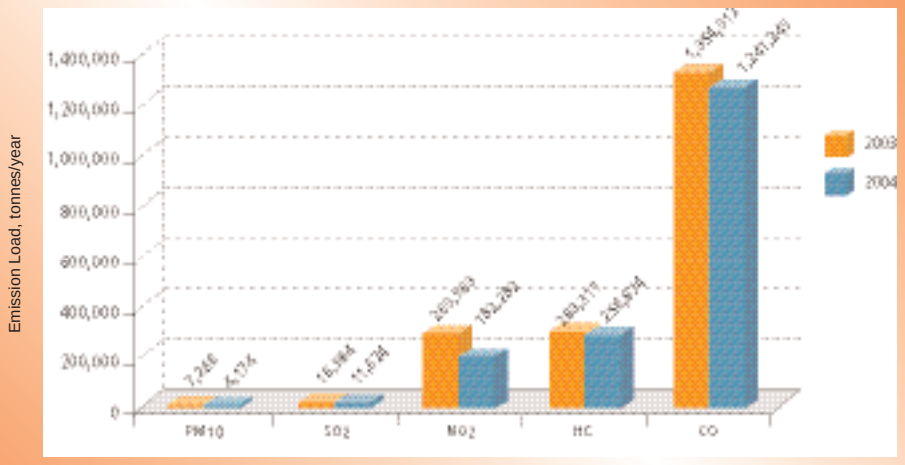

Figure 35 Malaysia: Air Pollutant Emission Load from Mobile Sources, 2003-2004

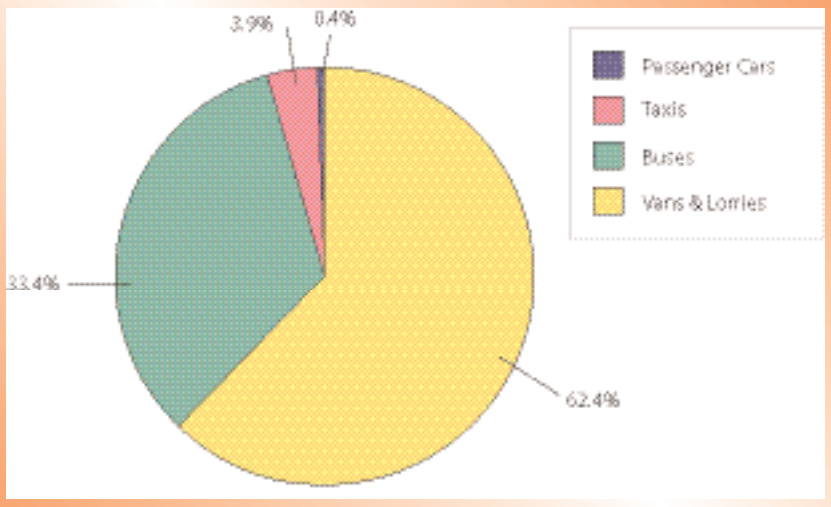

Figure 36 Malaysia: Distribution of PM_{10} Emission Load from Mobile Sources, 2004

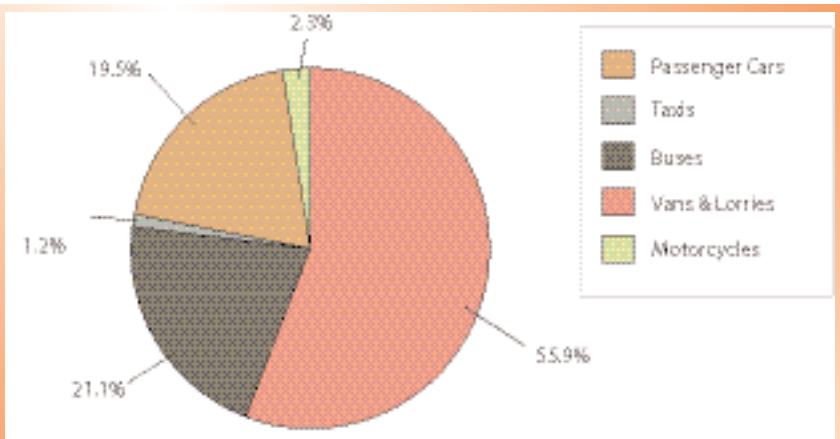

Figure 37 DOE: Distribution of NO_2 Emission Load from Mobile Sources, 2004

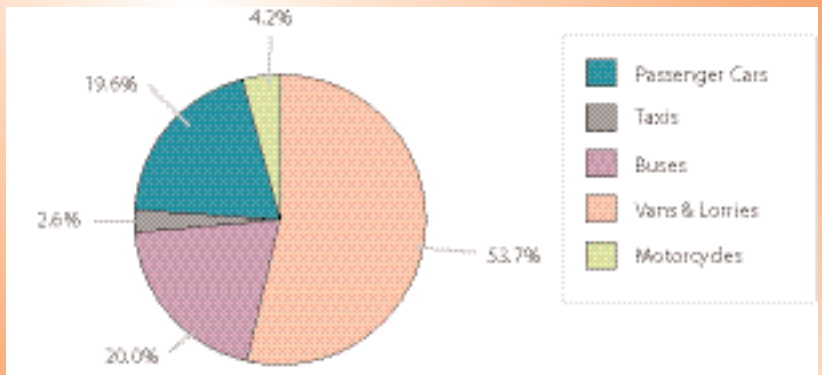

Figure 38 DOE: Distribution of SO_2 Emission Load from Mobile Sources, 2004

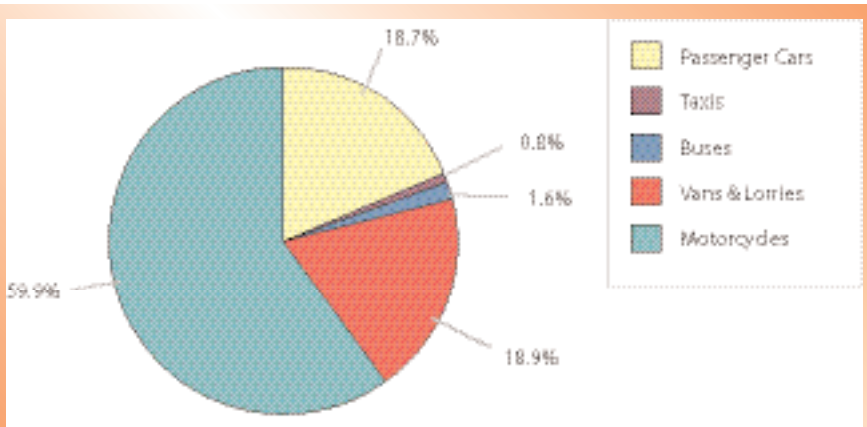

Figure 39 DOE: Distribution of HC Emission Load from Mobile Sources, 2004

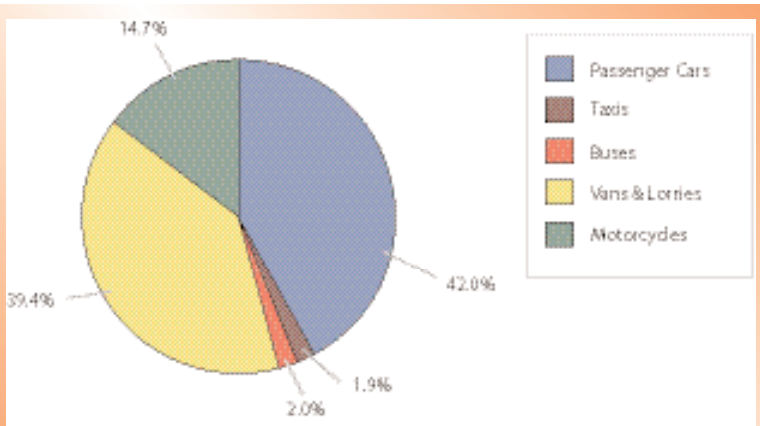

Figure 40 DOE: Distribution of CO Emission Load from Mobile Sources, 2004

SCHEDULED WASTES INVENTORY

Based on notification received by the Department of Environment (DOE), a total of 469,584.07 tonnes of scheduled wastes were produced in 2004 as compared to 460,865.74 tonnes generated in 2003. Dross/slag/clinker and oil and hydrocarbon made up the main categories of waste produced in the country. The breakdown according to waste categories and industry type are given in Table 13, 14, Figure 41 and Figure 42 respectively.

Of the total wastes produced, 88,268.0 tonnes (18.80%) were treated and disposed at the Kualiti Alam Treatment & Disposal Facility; 12,840.54 tonnes (2.73%) of clinical wastes were incinerated at licensed off-site facilities; 3,354.0 tonnes (0.71%) were exported for recovery purposes; 272,419.59 tonnes (58.02%) of scheduled wastes were recovered at off-site local facilities and an estimated 92,701.94 tonnes (19.74%) were treated and stored on-site at waste generators' premises (Table 15).

Six landfarms and 35 on-site waste incinera-

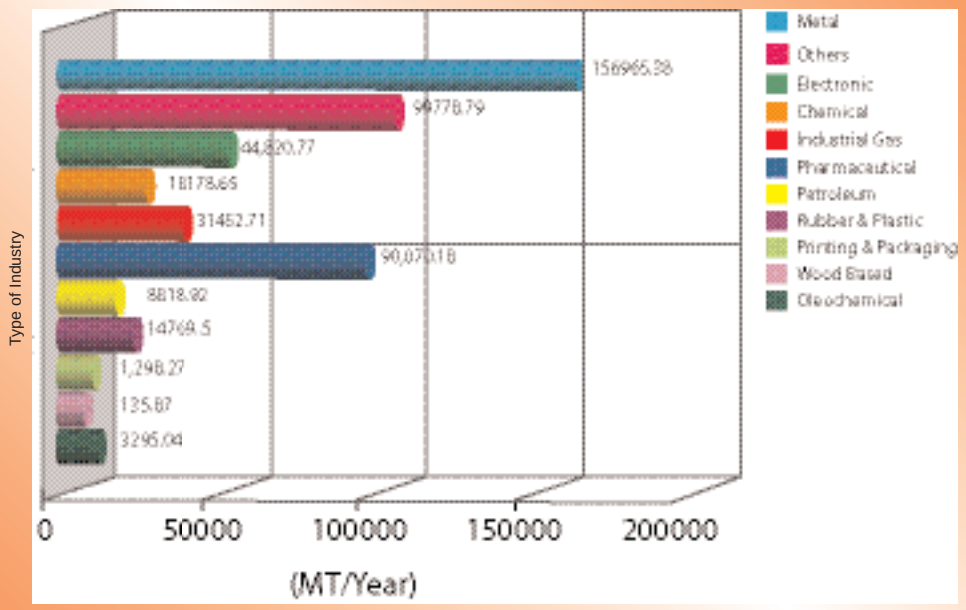

Figure 41 DOE: Quantity of Scheduled Wastes Generated by Industry, 2004

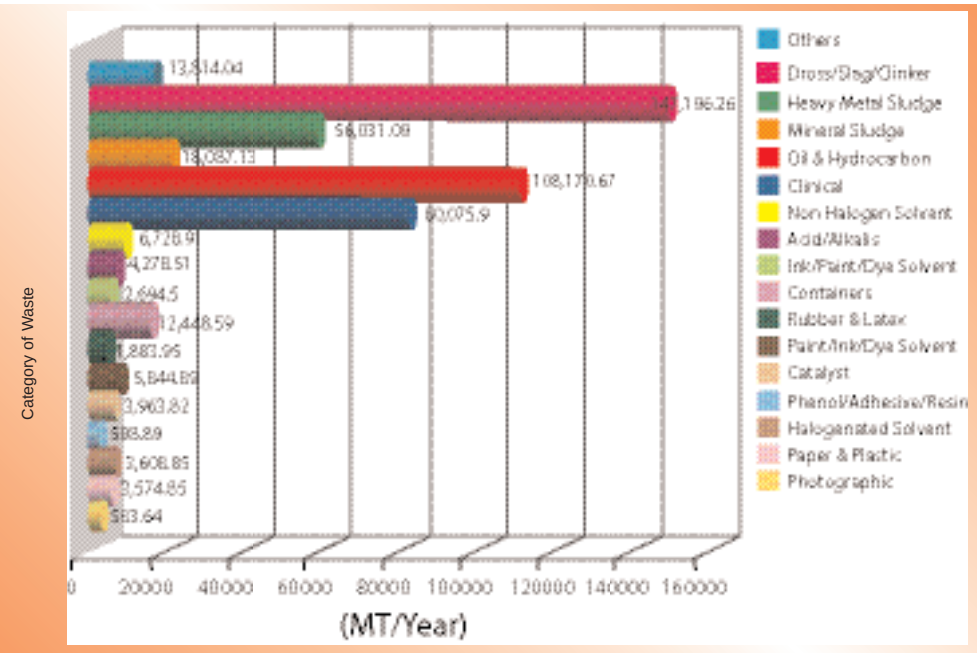

Figure 42 DOE: Quantity of Scheduled Wastes Generated by Category, 2004

Table 13 DOE: Quantity of Scheduled Wastes Generated by Industries, 2004

Industry	Quantity of Wastes (MT/Year)	Percentage (%)
Oleochemical	3,295.04	0.70
Wood Basis	135.87	0.03
Printing & Packaging	1,298.27	0.28
Rubber & Plastic	14,769.50	3.15
Petroleum	8,818.92	1.88
Pharmaceutical	90,070.18	19.18
Industrial Gas	31,452.71	6.70
Chemical	18,178.65	3.87
Electronic	44,820.77	9.54
Others	99,778.79	21.25
Metal	156,965.38	33.43
Total	**469,584.07**	**100.00**

Table 14 DOE: Quantity of Scheduled Wastes Generated by Category, 2004

Category Of Waste	Quantity Of Wastes (MT/Year)	Percentage (%)
Photographic	583.64	0.12
Halogenated Solvent	3,574.85	0.76
Paper & Plastic	3,608.43	0.77
Phenol/Adhesive/Resin	598.89	0.13
Catalyst	3,963.82	0.84
Paint/Ink/Dye Solvent	5,844.89	1.24
Rubber & Latex	1,883.95	0.40
Containers	12,448.59	2.65
Ink/Paint/Dye Sludge	2,694.50	0.57
Acid/Alkalis	4,278.51	0.91
Non Halogen Solvent	6,728.91	1.43
Clinical	80,075.90	17.05
Oil & Hydrocarbon	108,170.67	23.04
Mineral Sludge	18,087.13	3.85
Heavy Metal Sludge	56,031.09	11.93
Dross/Slag/Clinker	147,196.26	31.35
Others	13,814.04	2.94
Total	**469,584.07**	**100.00**

Table 15 Malaysia: Handling of Scheduled Wastes, 2004

Facility	Tonnes	Percentage (%)
Kualiti Alam Sdn. Bhd.	88,268.00	18.80
Foreign Facilities	3,354.00	0.72
Local Off-site Recovery Facilities	272,419.59	58.01
Off-site Clinical Waste Incinerators	12,840.54	2.73
On-site Treatment	53,061.30	11.30
On-site Storage	39,640.64	8.44
TOTAL	**469,584.07**	**100.00**

THE BASEL CONVENTION ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES AND THEIR DISPOSAL

In 2004, ten Written Approvals were issued for the import of 354,390 tonnes of wastes for use as raw materials. The wastes comprised of

- granulated blast furnace slag (293,684 MT: 82.87%)
- copper slag (58,723 MT: 16.57%)
- spent fluid cracking catalyst (1,108 MT: 0.31 %)
- plastic waste (875 MT: 0.25 %).

Figure 43 illustrates the import of wastes over the past five years (2000-2004). The spent catalyst and blast furnace slag were used as raw materials in cement manufacturing plants while the plastic waste was used as raw material for the plastic industry. The copper slag was used in sand blasting operations.

A total of 3,354 tonnes of scheduled wastes were exported in 2004. The exported wastes were derived from 36 waste generators and comprised of metal hydroxide sludge containing heavy metals such as

- silver, nickel and copper (2,494 MT: 74.36%)
- spent catalyst (722 MT: 21.52%)
- nickel cadmium battery (103 MT: 3.07%)
- used blasting material (25 MT: 0.75)
- used drums containing toxic and hazardous chemicals (10 MT: 0.29 %).

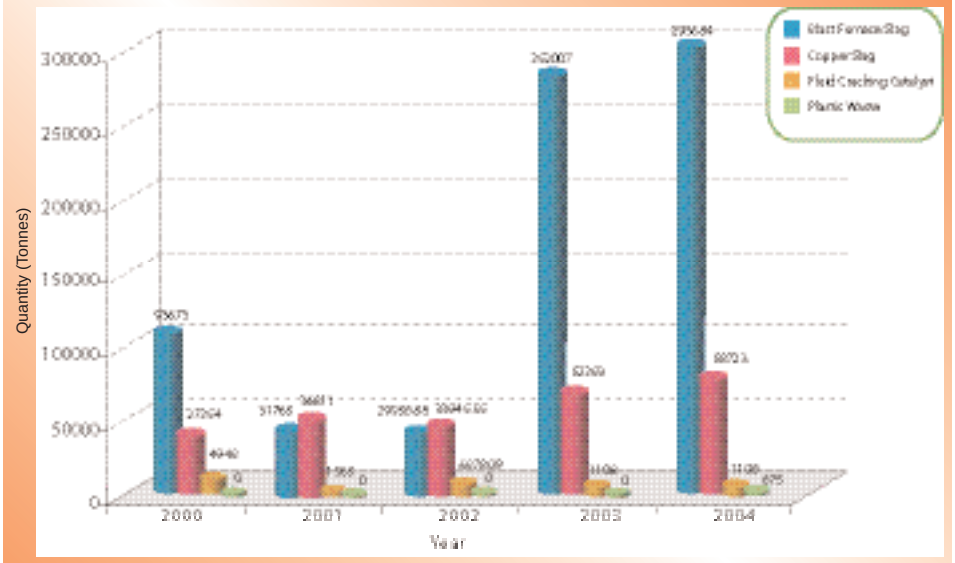

Figure 43 DOE: Quantity and Type of Scheduled Wastes Imported (Tonnes), 2000 - 2004

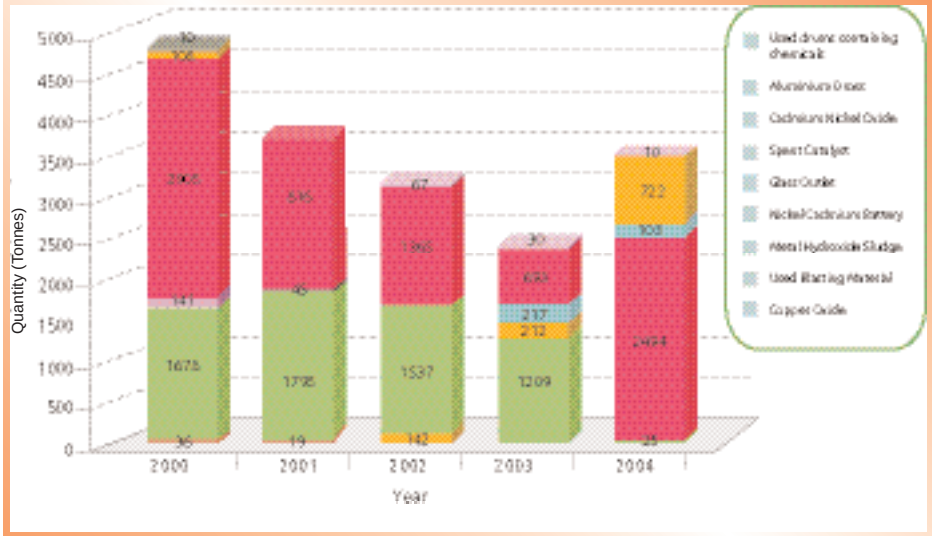

Figure 44 DOE: Quantity and Type of Scheduled Wastes Exported (Tonnes), 2000 - 2004

Table 16 DOE: Destination & Quantity of Scheduled Wastes Exported (Tonnes), 2000-2004

Country	2000	2001	2002	2003	2004
Australia	69.00	-	315.00	208.500	-
Germany	470.00	159.00	128.00	349.488	476
Holland	1234.00	487.00	569.58	322.770	294
Italy	-	107.00	44.10	27.520	-
Japan	1530.00	68.00	1,034.96	1006.891	1,019
Finland	-	-	100.00	23.000	190
France	108.00	-	66.61	98.751	189
Philippines	-	532.00		-	1,000
Singapore	500.00	-	170.00	-	22
South Korea	-	-		117.900	-
Sweden	203.00	27.00	149.00	7.000	6
Switzerland	10.00	-		-	-
Belgium	-	-	-	140.000	51
USA	753.00	1295.00	532.90	59.660	80
Canada	-	-	-	-	25
Total	**4,878**	**2,675**	**3,110**	**2,361**	**3,354**

Photo 21: Open Burning at Illegal Solid Waste Dumping Site (DOE Photo Library)

INTERIM NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

PARAMETERS	UNIT	CLASS				
		I	IIA / IIB	III#	IV	V
Al	mg/l	↑	-	- (0.06)	0.5	↑
As	mg/l		0.05	0.4 (0.05)	0.1	
Ba	mg/l		1	-	-	
Cd	mg/l		0.01	0.01* (0.001)	0.01	
Cr (IV)	mg/l		0.05	1.4 (0.05)	0.1	
Cr (III)	mg/l		-	2.5	-	
Cu	mg/l		0.02	-	0.2	
Hardness	mg/l		250	-	-	
Ca	mg/l	N	-	-	-	L
Mg	mg/l	A	-	-	-	E
Na	mg/l	T	-	-	3 SAR	V
K	mg/l	U	-	-	-	E
Fe	mg/l	R	1	1	1 (Leaf) 5(Others)	L
Pb	mg/l	A	0.05	0.02* (0.01)	5	S
Mn	mg/l	L	0.1	0.1	0.2	
Hg	mg/l		0.001	0.004 (0.0001)	0.002	A
Ni	mg/l	L	0.05	0.9*	0.2	B
Se	mg/l	E	0.01	0.25 (0.04)	0.02	O
Ag	mg/l	V	0.05	0.0002	-	V
Sn	mg/l	E	-	0.004	-	E
U	mg/l	L	-	-	-	
Zn	mg/l	S	5	0.4 *	2	IV
B	mg/l	↓	1	- (3.4)	0.8	↓
Cl	mg/l		200	-	80	
Cl_2	mg/l			- (0.02)	-	
CN	mg/l		0.02	0.06 (0.02)	-	
F	mg/l		1.5	10	1	
NO_2	mg/l		0.4	0.4 (0.03)	-	
NO_3	mg/l		7	-	5	
P	mg/l		0.2	0.1	-	
Silica	mg/l		50	-	-	
SO_4	mg/l		250	-	-	
S	mg/l		0.05	- (0.001)	-	
CO_2	mg/l			-	-	
Gross - alfa	Bq/L		0.1	-	-	
Gross - beta	Bq/L		1	-	-	
Ra - 226	Bq/L		<0.1	-	-	
Sr - 90	Bq/L		<1	-	-	↓
CCE	ug/l		500	-	-	-
MBAS/BAS	ug/l		500	5000 (200)	-	-
O & G (Mineral)	ug/l		40 ; N	N	-	-
O & G (Emulsified edible)		ug/l		7000 ; N	N	-
PCB	ug/l		0.1	6 (0.05)	-	-
Phenol	ug/l		10	-	-	-
Aldrin/Dieldrin	ug/l		0.02	0.2 (0.01)	-	-
BHC	ug/l		2	9 (0.1)	-	-
Chlordane	ug/l		0.08	2 (0.02)	-	-
t - DDT	ug/l	↓	0.1	(1)	-	-
Endosulfan	ug/l		10	-	-	-
Heptachlor / Epoxide	ug/l	OR	0.05	0.9 (0.06)	-	-
Lindane	ug/l		2	3 (0.4)	-	-
2,4 -D	ug/l	A	70	450	-	-
2,4,5 - T	ug/l	B	10	160	-	-
2,4, 5 - TP	ug/l	S	4	850	-	-
Paraquat	ug/l	E	10	1800	-	-
		N				
		T				

* = At hardness 50 mg/l $CaCO_3$

\# = Maximum (unbracketed) and 24 - hour average (bracketed) concentrations

N = Free from visible film sheen, discolouration and deposits

Interim National Water Quality Standards for Malaysia

PARAMETERS	UNIT	CLASS					
		I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/l	0.1	0.3	0.3	0.9	2.7	>2.7
BOD	mg/l	1	3	3	6	12	>12
COD	mg/l	10	25	25	50	100	>100
DO	mg/l	7	5 - 7	5 - 7	3 - 5	<3	<1
pH		6.5 - 8.5	6 - 9	6 - 9	5 - 9	5 - 9	-
Colour	TCU	15	150	150	-	-	-
Elec. Conductivity *	umhos/cm	1000	1000	-	-	6000	-
Floatables		N	N	N	-	-	-
Odour		N	N	N	-	-	-
Salinity (%)	%	0.5	1	-	-	2	-
Taste		N	N	N	-	-	-
Total Dissolved Solid	mg/l	500	1000	-	-	4000	-
Total Suspended Solid	mg/l	25	50	50	150	300	300
Temperature (C)	°C	-	Normal +2°C		Normal +2°C	-	-
Turbidity (NTU)	NTU	5	50	50	-	-	-
Faecal Coliform **	counts/100mL	10	100	400	5000 (20000)[a]	5000 (20000)[a]	-
Total Coliform	counts/100mL	100	5000	5000	50000	50000	>50000

Notes

N : No visible floatable materials or debris, No objectionable odour; No objectionable taste

* : Related parameters, only one recommended for use

** : Geometric mean

a : Maximum not to be exceeded

Class **Uses**

CLASS I : Conservation of natural environment
Water Supply 1 - practically no treatment necessary
Fishery 1 - very sensitive aquatic species

CLASS IIA : Water Supply II - conventional treatment required
Fishery ll - sensitive aquatic species

CLASS IIB : Recreational use with body contact

CLASS III : Water Supply lll - extensive treatment required
Fishery lll - common, of economic value, and tolerant species; livestock drinking

CLASS IV : Irrigation

CLASS V : None of the above

Malaysia : DOE Water Quality Index Classification

PARAMETERS	UNIT	CLASS				
		I	II	III	IV	V
Ammoniacal Nitrogen	mg/l	< 0.1	0.1 - 0.3	0.3 - 0.9	0.9 - 2.7	> 2.7
Biochemical Oxygen Demand	mg/l	< 1	1 - 3	3 - 6	6 - 12	> 12
Chemical Oxygen Demand	mg/l	< 10	10 - 25	25 - 50	50 - 100	> 100
Dissolved Oksigen	mg/l	> 7	5 - 7	3 - 5	1 - 3	< 1
pH	mg/l	> 7.0	6.0 - 7.0	5.0 - 6.0	< 5.0	> 5.0
Total Suspended Solids	mg/l	< 25	25 - 50	50 - 150	150 - 300	> 300
Water Quality Index		> 92. 7	76.5 - 92.7	51.9 - 76.5	31.0 - 51.9	< 31.0

Malaysia : DOE Water Quality Classification Based on Water Quality Index

PARAMETER	INDEX RANGE		
	CLEAN	SLIGHTLY POLLUTED	POLLUTED
Water Quality Index (WQI)	81 - 100	60 - 80	0 - 59
Biochemical Oxygen Demand (BOD)	91 - 100	80 - 90	0 - 79
Ammoniacal Nitrogen (NH3-N)	92 - 100	71 - 91	0 - 70
Suspended Solids (SS)	76 - 100	70 - 75	0 - 69

Chapter 5

POLLUTION SOURCES INVENTORY