



AIR QUALITY

RIVER WATER QUALITY

GROUNDWATER QUALITY

MARINE WATER QUALITY

POLLUTION SOURCES INVENTORY

# MALAYSIA Environmental Quality Report 2004



Department of Environment  
Ministry of Natural Resources and Environment  
Malaysia

# MALAYSIA

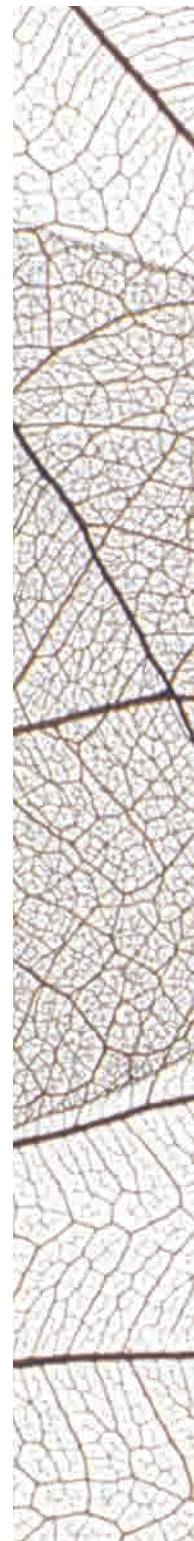
## Environmental

### Quality Report

# 2004



Department of Environment  
Ministry of Natural Resources and Environment  
Malaysia



DEPARTMENT OF ENVIRONMENT, MALAYSIA

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Printed on Recycled Paper

Edited by  
Publication Section,  
Strategic Communications Division  
Department of Environment  
Malaysia

ISSN 0127-6433

Design & Print: Sasyaz Holdings Sdn Bhd (219275V)  
29, Jalan PJU 3/48, Sunway Damansara Technology Park,  
47810 Petaling Jaya, Malaysia  
Tel: 603-7803 3754 Fax: 603-7804 8245

MALAYSIA ENVIRONMENTAL  
QUALITY REPORT 2004

ISSN 0127-6433



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# Foreword

In compliance with Section 3(1)(i) of the Environmental Quality Act (EQA), 1974, the 2004 Environmental Quality Report is hereby presented.



Managing the environment sustainably is a challenging task, more so in recent years due to increasing demands on depleting resources and the rapid pace of development. Thus the environmental issues we encounter today are more complex and require more integrated solutions. The traditional management tools alone such as regulatory control are not enough under present circumstances. New innovative means and measures need to be devised by which these complex environmental problems can be dealt with effectively.

Another new dimension to the environmental scenario is the impact of transboundary pollution which has brought to the forefront the reality that pollution respects no boundaries. The haze episodes and the socio-economic impacts speak volumes of this hitherto unrecognised environmental threat.

The Department of Environment will gear itself up to meet these challenges. Foremost in our agenda is to ensure that the environment remains clean, safe, healthy and productive, both ecologically and environmentally, in order to support the socio-economic development of the country.

A handwritten signature in black ink, appearing to read "Rosnani".

"Bandar Lestari - Promoting Sustainable Cities"

With Best Wishes

# AIR QUALITY



Photo 1: Urban Air Pollution from Mobile Sources

(DOE Photo Library)

Malaysia experienced short periods of slight to moderate haze in the months of June, August and September brought about mainly by trans-

## AIR QUALITY MONITORING

The Department of Environment (DOE) monitors the country's ambient air quality through a network of 51 stations (Map 1a and 1b). These monitoring stations are strategically located in both residential and industrial areas to detect any significant change in the air quality which may be harmful to human health and the environment.

The National Air Quality Monitoring network is also supplemented by manual air quality monitoring stations (High Volume Sampler) located at 25 different sites. At these sites, total suspended particulates, particulate matter ( $PM_{10}$ ) and several heavy metals such as lead are measured once in every six days.

## AIR QUALITY STATUS

The air quality status for Malaysia is determined according to the Air Pollutant Index (API) as shown in Table 1. The overall air quality for Malaysia throughout 2004 deteriorated slightly compared to the previous year. Several unhealthy air quality days were recorded at various locations in Wilayah Persekutuan Kuala Lumpur, Selangor, Penang, Perak, Negeri Sembilan and Melaka. The unhealthy days recorded in the Klang Valley (Wilayah Persekutuan Kuala Lumpur and Selangor) and Negeri Sembilan were mainly caused by high concentrations of ground level ozone.

On the other hand, the unhealthy air quality recorded in other parts of the country was mainly due to high levels of  $PM_{10}$ . In 2004,

API	Air Quality Status
0-50	Good
51-100	Moderate
101-200	Unhealthy
201-300	Very unhealthy
>300	Hazardous

influence of south westerly winds contributed to the deterioration of air quality in the west coast of Peninsular Malaysia. The fires in Kalimantan also contributed to the slight haze in the southern part of Sarawak. Apart from these haze episodes, there was no other serious incidences air pollution in 2004. Particulate Matter ( $PM_{10}$ ) and ground level ozone remained the prevailing pollutants in the country.

In 2004, the air quality in the Klang Valley was in the moderate category 70 percent of the time and the predominant pollutant was ozone formed by the reaction of volatile organic compounds (VOCs) and  $\text{NO}_x$  in the presence of strong solar radiation. However,  $\text{PM}_{10}$  was the predominant pollutant for unhealthy conditions in the dry season during the south westerly monsoon. The highest number of unhealthy days recorded at one location in 2004 was 88 days, compared to 56 days in 2003 (Figure 1). The overall air quality status in Klang Valley is shown in Figure 2.

### Northern Region

In the northern region of the West Coast of Peninsular Malaysia, comprising the States of Perlis, Kedah including Langkawi, Pulau Pinang and Perak, the overall air quality was between good and moderate most of the time. Good air quality was recorded in Langkawi, Pulau Pinang (USM), Taiping and Alor Setar more than 55 percent of the time. Kangar experienced good air quality for 24 percent of the time and moderate air quality for the rest of the remaining time. Sungai Petani experienced 40 percent of good air quality time, 58 percent moderate and remaining 2 percent unhealthy quality mainly due to high levels of ozone concentration.

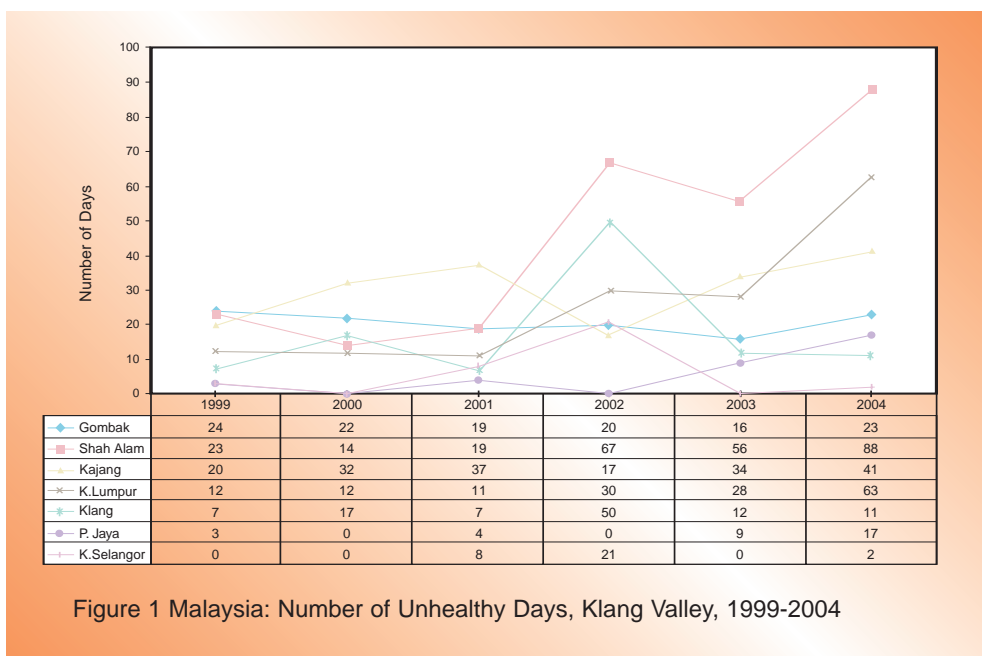


Figure 1 Malaysia: Number of Unhealthy Days, Klang Valley, 1999-2004

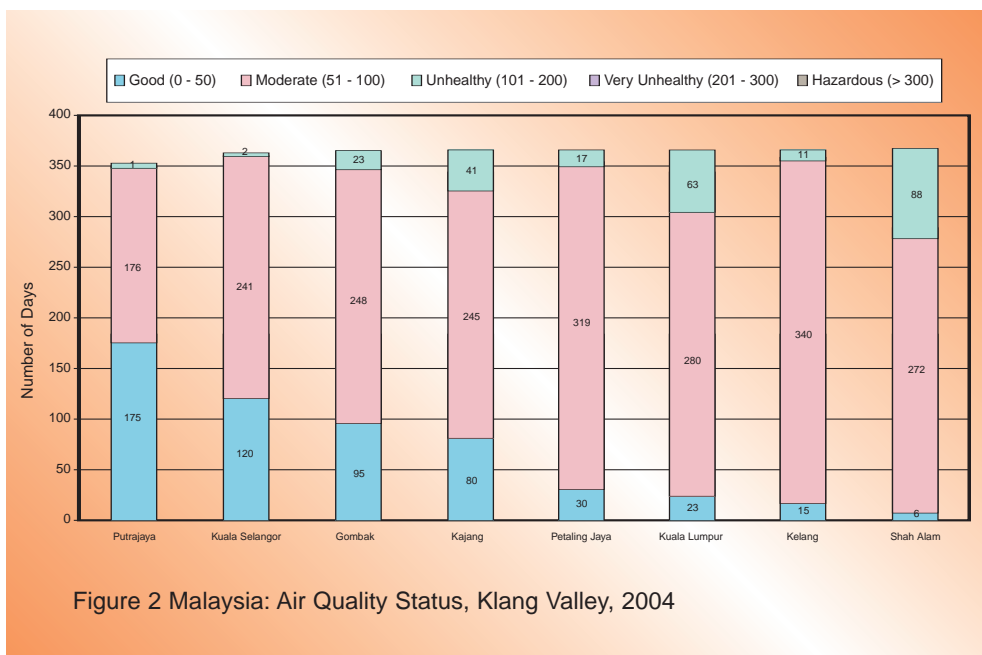
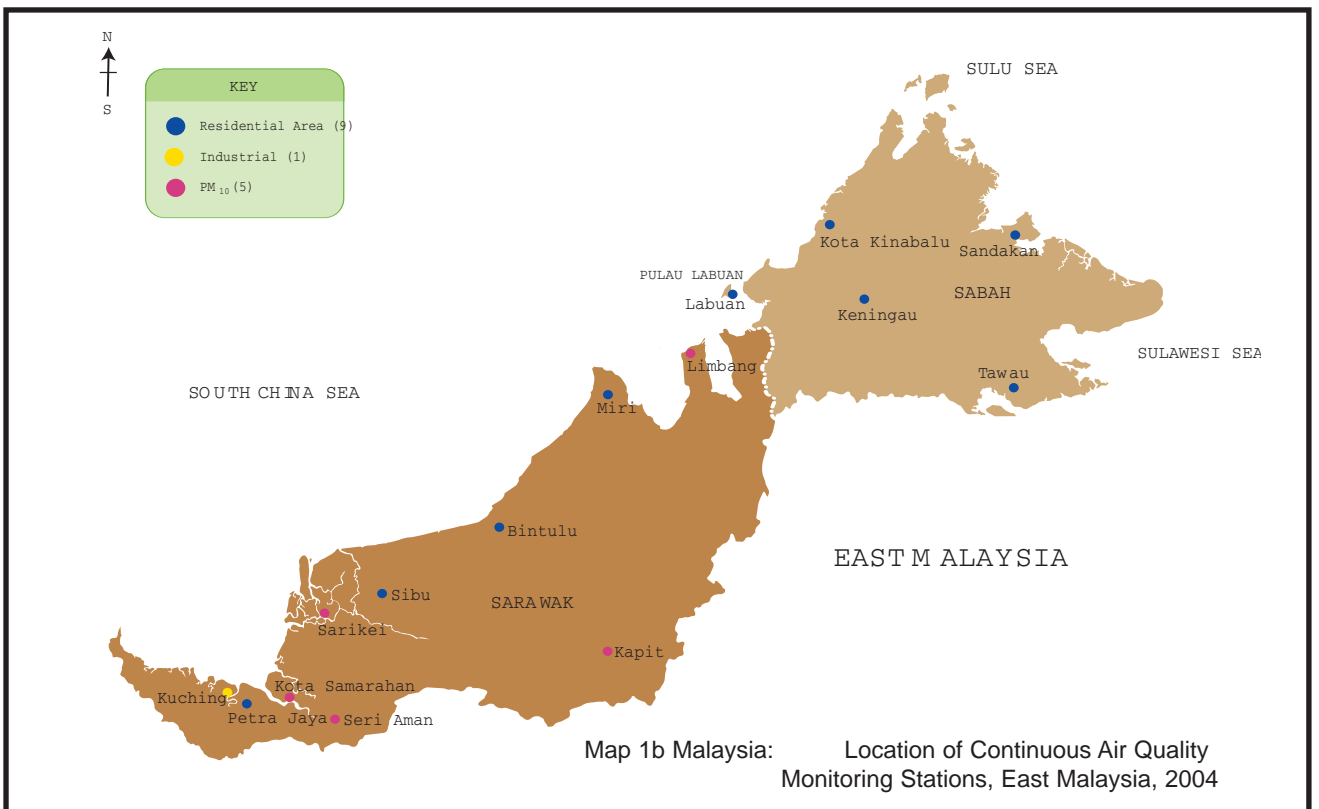
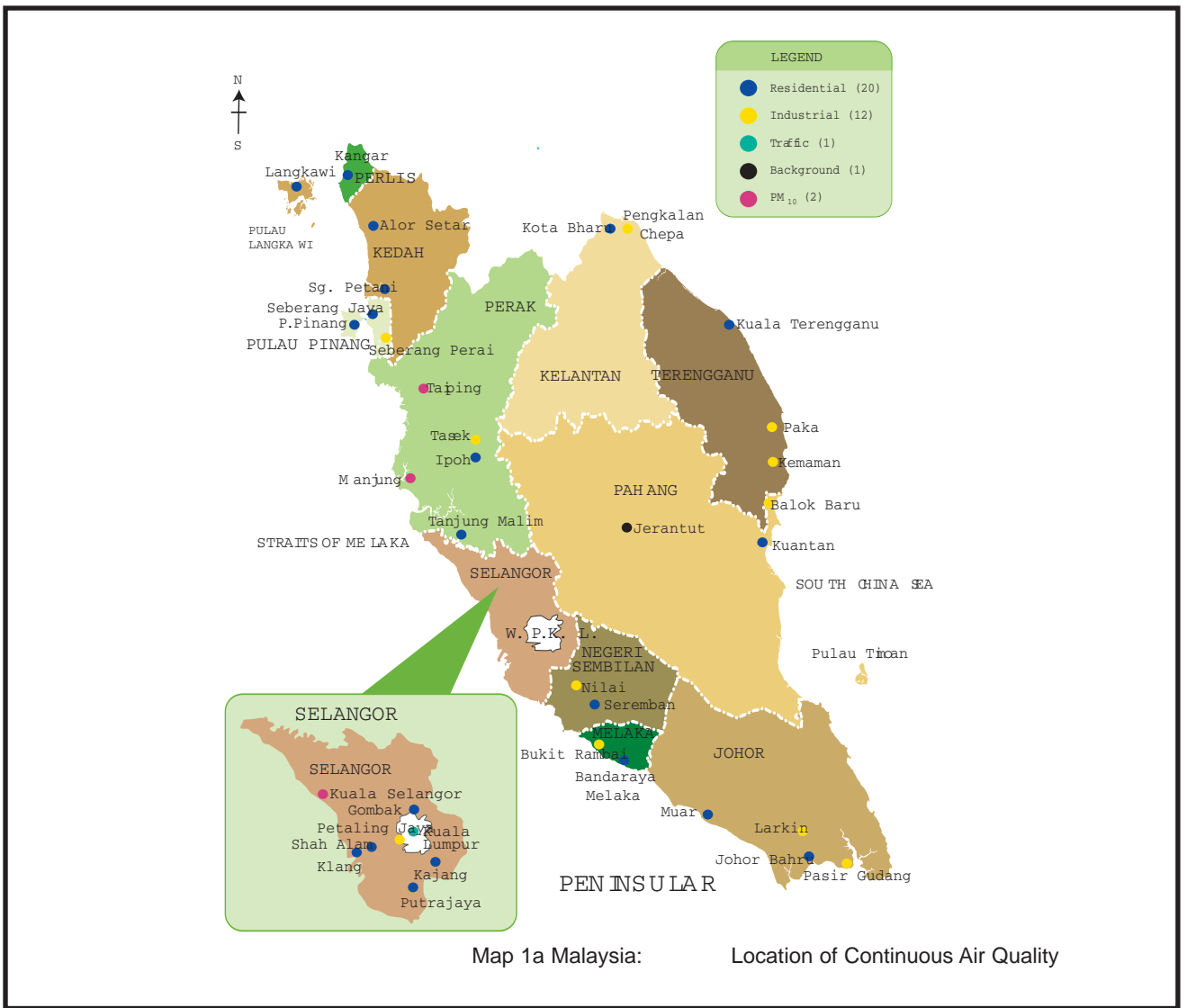


Figure 2 Malaysia: Air Quality Status, Klang Valley, 2004

Air quality stations in Seberang Prai recorded moderate air quality 97 percent of the time and unhealthy air quality for the remaining three percent.  $\text{PM}_{10}$  was the main pollutant detected in the area. Main sources of  $\text{PM}_{10}$  identified were industrial activities, motor vehicle emissions and trans-boundary pollution which occurred during the south westerly monsoon. Notably, the high levels of sulphur dioxide ( $\text{SO}_2$ ) observed in previous years were significantly reduced. This could be attributed to the measures taken to promote the use of cleaner fuel such as natural gas in the industrial combustion process.



## Southern Region

Similarly, the status of air quality observed in the southern region of the West Coast of Peninsular Malaysia, which incorporates the States of Negeri Sembilan, Melaka and Johor, was between good to moderate most of the time, with the exception of a few unhealthy days. In Negeri Sembilan, the air quality station in Seremban recorded 66 percent moderate air quality days, 33 percent good air quality days and one percent (3 days) unhealthy air quality days in 2004. In Nilai, it was observed that more moderate air quality days (81%) were recorded as compared to good days (16%). Throughout the year, seven unhealthy days were recorded in this

area. Nilai is located south of the Klang Valley and is bounded by a mountain range on the eastern side which reduces dispersion of industrial emission in the area. This topography also contributes to the accumulation of PM<sub>10</sub> and ground level ozone generated by industrial activities and motor vehicle emissions.

In Bandaraya Melaka, the air quality was good for more than 60 percent of the time, while in Bukit Rambai the air quality was moderate 97 percent of the time. Both areas recorded several unhealthy air quality days mainly due to trans-boundary pollution during the south westerly monsoon. Bukit Rambai has an air quality station located in a wood-based industrial zone. All four

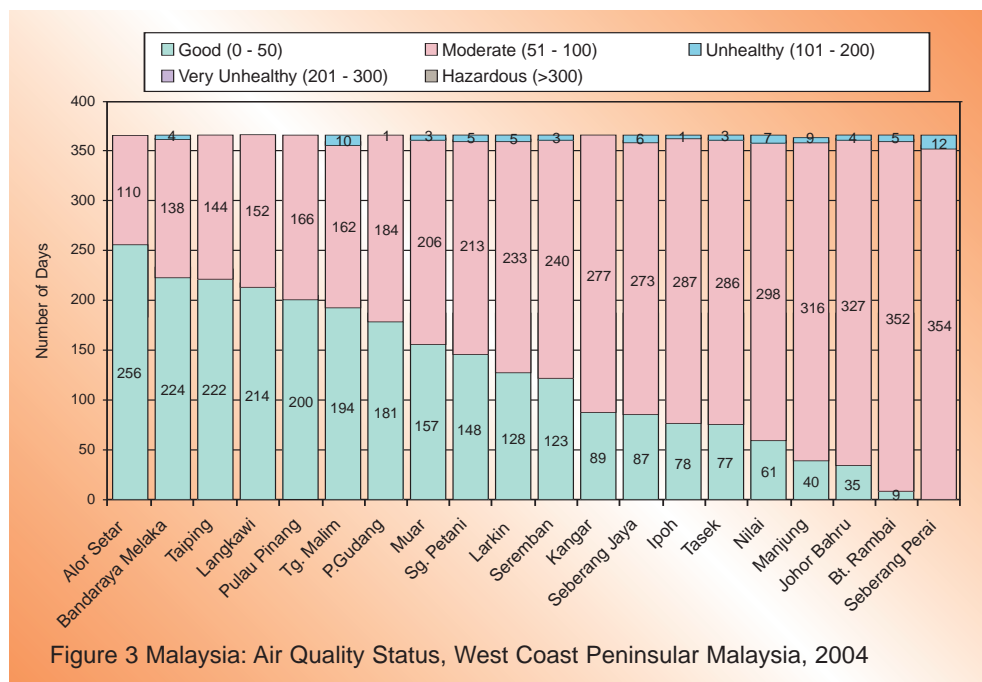


Figure 3 Malaysia: Air Quality Status, West Coast Peninsular Malaysia, 2004

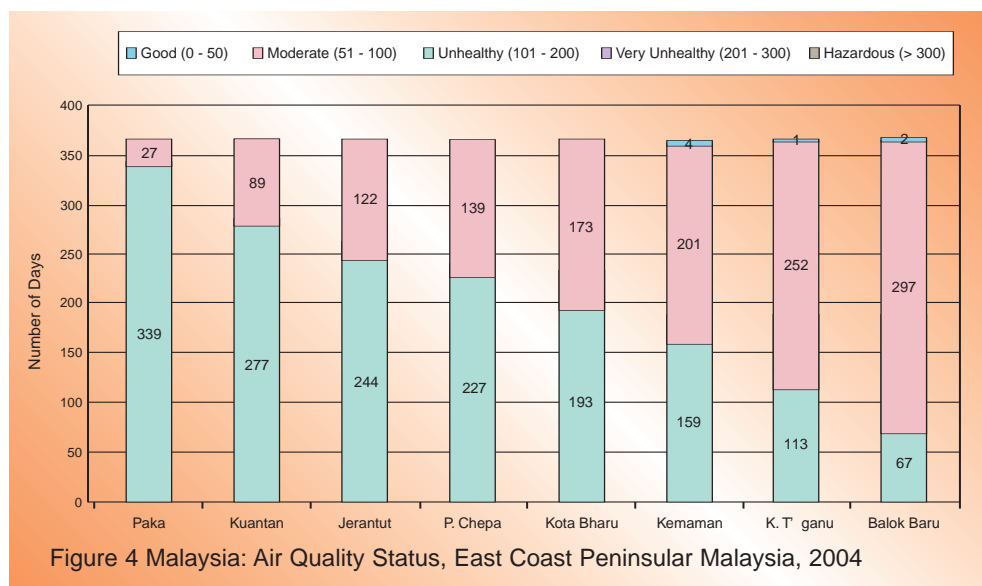


Figure 4 Malaysia: Air Quality Status, East Coast Peninsular Malaysia, 2004

stations in Johor recorded less than 50 percent good air quality days and several unhealthy air quality days in 2004. Ozone was the predominant pollutant causing unhealthy days in these areas. Figure 3 describes the overall air quality status for the West Coast of Peninsular Malaysia.

## Air Quality Status in the East Coast

The air quality in the East Coast of Peninsular Malaysia remained good most of the time. Areas such as Kuantan, Jerantut, Paka and Pengkalan Chepa experienced good air quality for more than 60 percent of the time, while Kemaman, Kuala Terengganu, Kota Bharu and Balok Baru experi-

## Air Quality Status in Sabah, Wilayah Persekutuan Labuan and Sarawak

The air quality in Sandakan, Kota Kinabalu and Keningau in Sabah was good for more than 85 percent of the time, while Tawau recorded more moderate air quality than good air quality days. No unhealthy days were recorded at all the locations in Sabah. In Labuan, the air quality was good 83 percent of the time and moderate for the remaining 17 percent.

Most stations in Sarawak experienced more than 85 percent good air quality days in 2004 (Figure 5). Stations in Sri Aman, Petra Jaya and Samarahan recorded between two and 17 unhealthy air quality days. The unhealthy air quality days were caused by high concentrations of particulate level due to trans-boundary pollution.

### AIR QUALITY TRENDS

Six criteria pollutants, namely Carbon Monoxide (CO), Nitrogen Dioxide (NO<sub>2</sub>), Ozone (O<sub>3</sub>), Sulphur Dioxide (SO<sub>2</sub>) and Particulate Matter (PM<sub>10</sub>) were monitored continuously at 51 locations, while Lead (Pb) concentration was measured once in every six days at three locations. The air quality trend for the period 1996 to 2004 was computed by averaging direct measurements from the monitoring sites on a yearly basis and cross-referene to the Malaysian Ambient Air Quality Guidelines shown in Table 2.

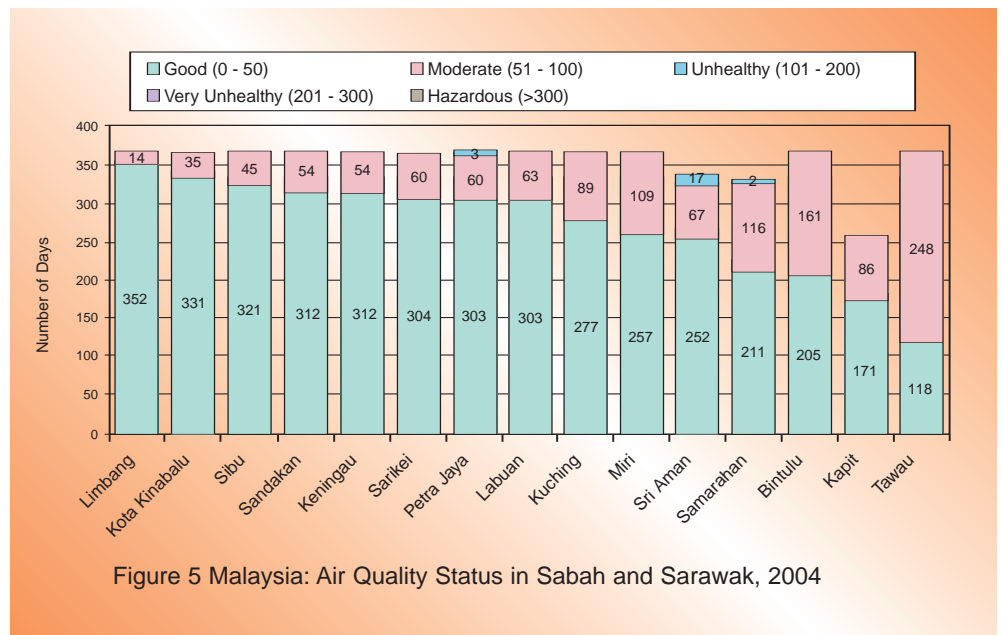


Figure 5 Malaysia: Air Quality Status in Sabah and Sarawak, 2004

Table 2 Malaysia: Ambient Air Quality Guidelines

Pollutant	Averaging Time	Malaysia Guideline	
		ppm	(ug/m <sup>3</sup> )
Ozone	1 Hour	0.10	200
	8 Hours	0.06	120
Carbon Monoxide	1 Hour	30	35
	8 Hours	9	10
Nitrogen Dioxide	1 Hour	0.17	320
	24 Hours	0.04	
Sulphur Dioxide	1 Hour	0.13	350
	24 Hours	0.04	105
Particulate Matter (PM <sub>10</sub> )	24 Hours		150
	1 Year		50
Total Suspended Particulate (TSP)	24 Hours		260
	1 Year		90
Lead	3 Months		1.5

### Particulate Matter (PM<sub>10</sub>)

Particulate Matter is the general term used to describe respirable particles of less than 10 microns in size. They may be from motor vehicle exhaust,

This pollutant can cause eye and throat irritation, and the accumulation of particulate matter in the respiratory system is associated with numerous respiratory problems such as decreased lung function. High levels of particulate matter can also pose health risk to sensitive groups such as children, the elderly and individuals with asthma or cardiopulmonary diseases.

Particulate matter ( $PM_{10}$ ) can also cause undesirable impact on the environment. The presence of high levels of  $PM_{10}$  in the atmosphere is a major cause of reduced visibility, resulting in hazy conditions especially during the dry season. Other environmental impacts can occur when particulate matter is deposited onto soil, plants, water or other materials.

Depending on the chemical composition of these substances, when particulate matter is deposited in sufficient quantities, it may change the nutrient balance and acidity in soil, interfere with plant metabolism and change the composition of the materials.

$PM_{10}$  continues to be the prevalent pollutant in many areas in Malaysia. The annual average lev-

els of  $PM_{10}$  concentration in the ambient air between 1996 and 2004 were just slightly below the Malaysian Ambient Air Quality Guideline for  $PM_{10}$  except in 1997, when the country experienced severe haze episodes, and in 2002, when the annual average concentration of  $PM_{10}$  was equivalent to the Malaysian Ambient Air Quality Guidelines.

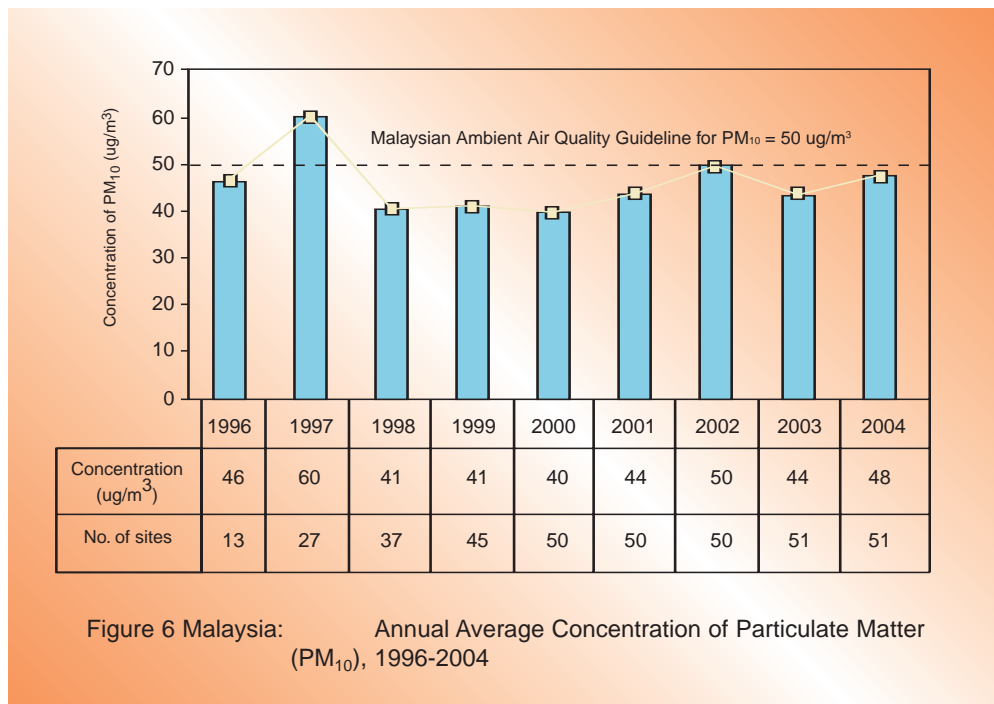


Figure 6 Malaysia: Annual Average Concentration of Particulate Matter ( $PM_{10}$ ), 1996-2004

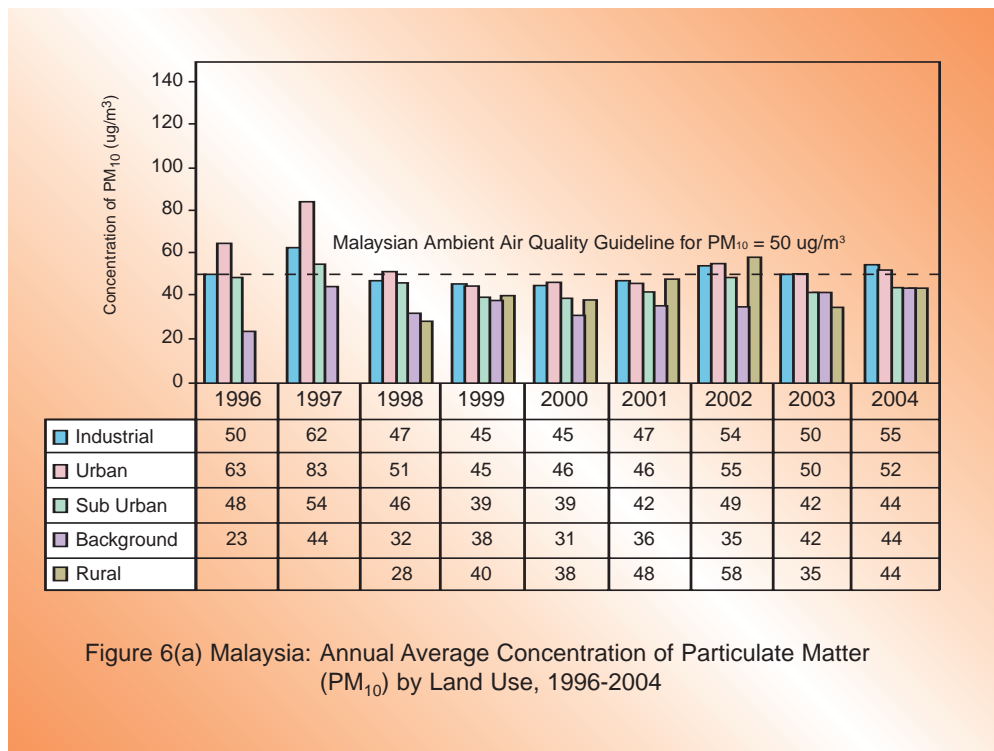


Figure 6(a) Malaysia: Annual Average Concentration of Particulate Matter ( $PM_{10}$ ) by Land Use, 1996-2004



Photo 2: Aerial Photo of Open Burning at Agricultural Site (DOE Photo Library)

### Sulphur Dioxide (SO<sub>2</sub>)

Sulphur Dioxide is a colourless, pungent, irritating, water-soluble reactive gas. This gas is formed during the combustion process of fuel containing sulphur (e.g. oil and coal) mainly in industrial activities. High concentrations of SO<sub>2</sub> in the atmosphere increase the risk of adverse symptoms in asthmatic patients and irritate the respiratory system. Other effects associated with long-term exposure to high concentrations of SO<sub>2</sub> coupled with high levels of particulate matter include respiratory illnesses, alterations

in lung function and aggravation of existing cardiovascular diseases.

There are also environmental concerns associated with high concentrations of SO<sub>2</sub>. Sulphur dioxide along with NO<sub>x</sub> is a major precursor to acidic deposition, which contributes to the acidification of soils, lakes and streams and can cause adverse impact on the ecosystem. Sulphur dioxide can also be harmful to plant life and accelerates the corrosion of buildings and monuments.

The annual average levels of SO<sub>2</sub> in the ambient air between 1996 and 2004 (Figure 7) were well below the Malaysian Ambient Air Quality Guideline. Figure 7(a) shows the annual average concentra-

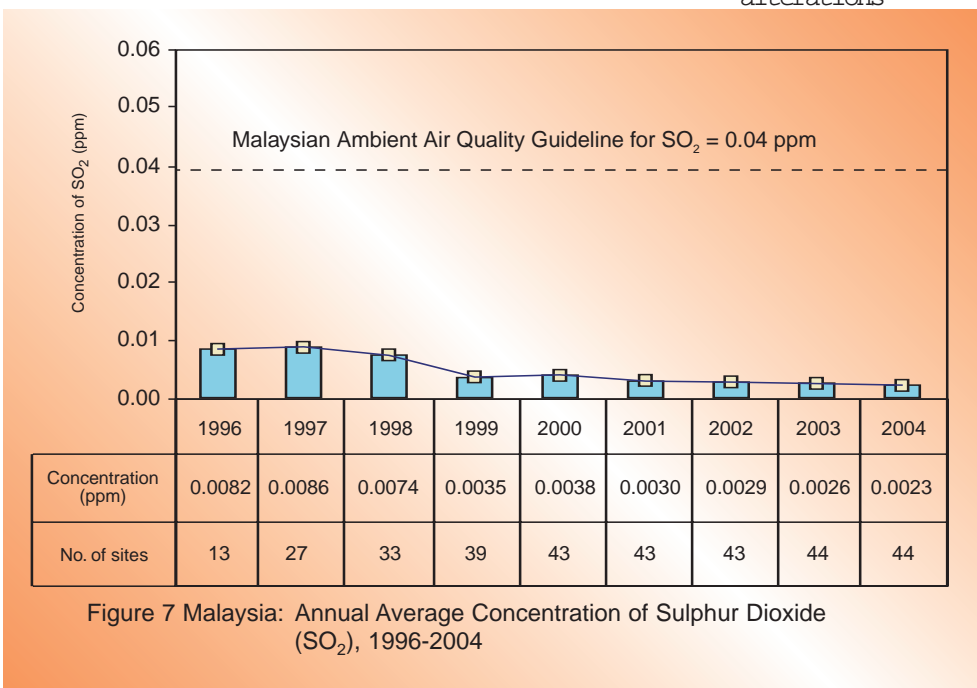


Figure 7 Malaysia: Annual Average Concentration of Sulphur Dioxide (SO<sub>2</sub>), 1996-2004

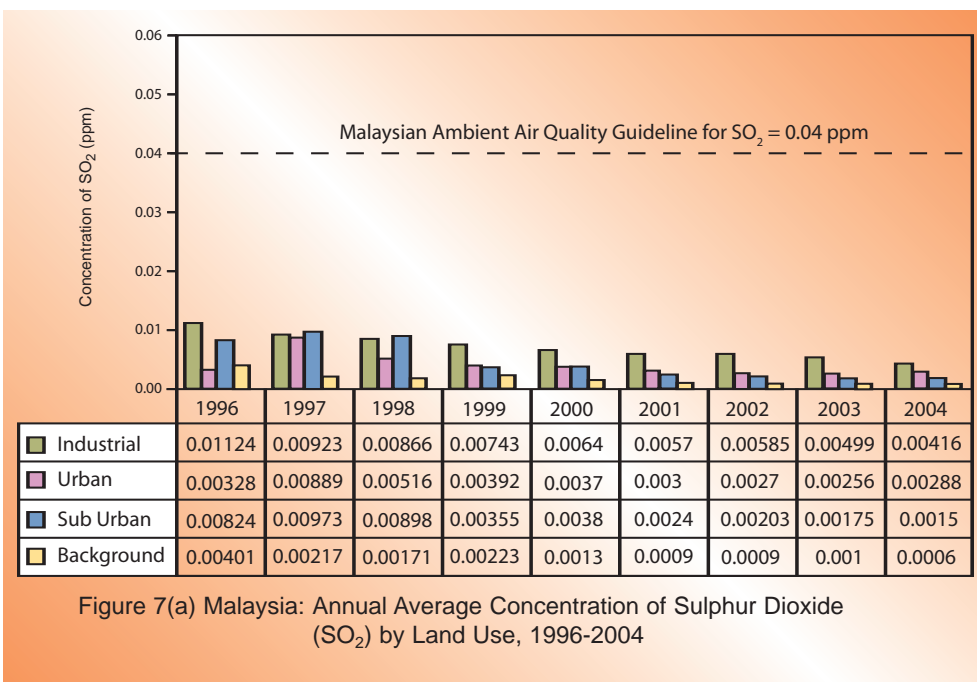


Figure 7(a) Malaysia: Annual Average Concentration of Sulphur Dioxide (SO<sub>2</sub>) by Land Use, 1996-2004

## Nitrogen Dioxide (NO<sub>2</sub>)

Nitrogen dioxide (NO<sub>2</sub>) is a reddish brown, highly reactive gas that is formed in the ambient air through the oxidation of nitrogen monoxide. Nitrogen oxides (NO<sub>x</sub>) is the term used to describe the sum of NO, NO<sub>2</sub> and other oxides of nitrogen. The major sources of man-made NO<sub>x</sub> emissions are high-temperature combustion processes, such as those occurring in automobiles and power plants. Most of the NO<sub>x</sub> (95 percent) from combustion processes are emitted as NO and the rest as NO<sub>2</sub>. Nitrogen monoxide (NO) is readily converted to NO<sub>2</sub> in the environment.

Short-term exposure to NO<sub>2</sub> may lead to changes in airway responsiveness and lung function in individuals with pre-existing respiratory illnesses and increases respiratory illness in children. Long-term exposure may increase susceptibility to respiratory infection and cause alteration in lung function. Nitrogen oxides also react in the air to form ground-level ozone and fine

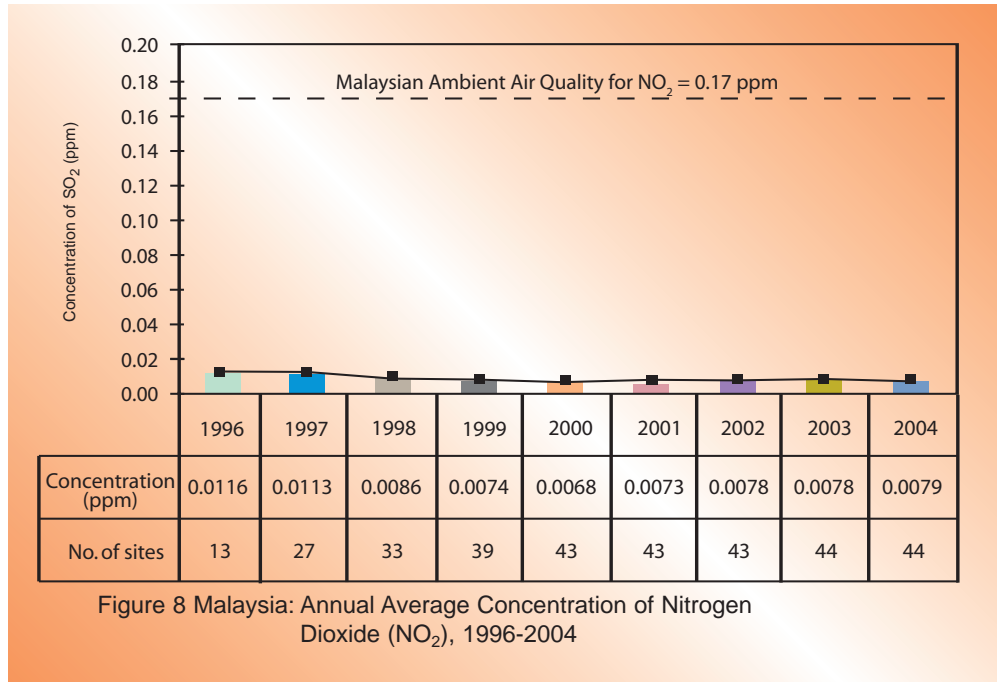


Figure 8 Malaysia: Annual Average Concentration of Nitrogen Dioxide (NO<sub>2</sub>), 1996-2004

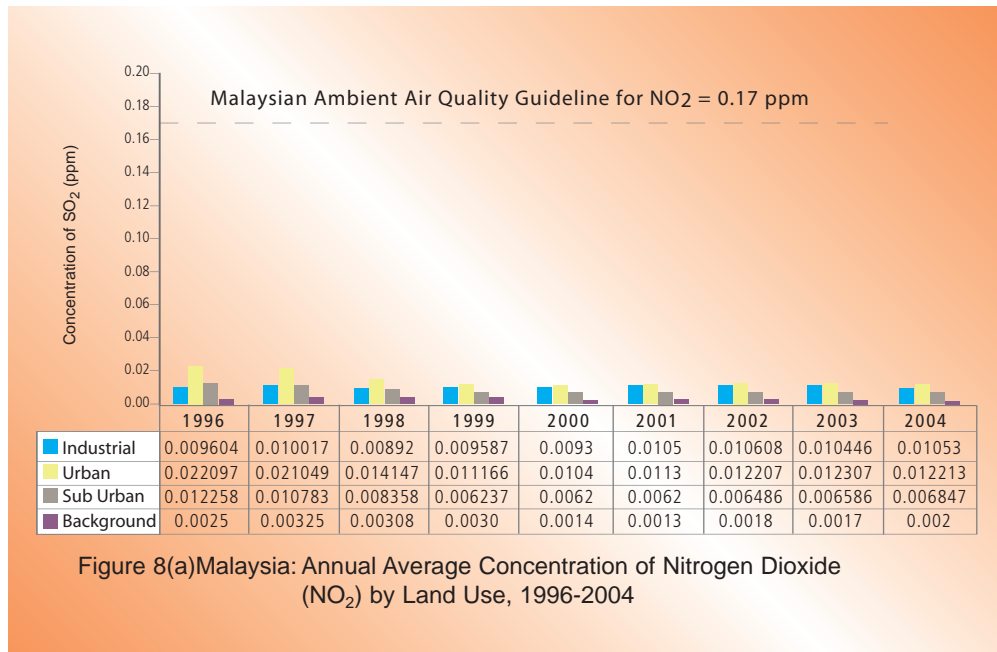


Figure 8(a)Malaysia: Annual Average Concentration of Nitrogen Dioxide (NO<sub>2</sub>) by Land Use, 1996-2004



Photo 3: Continuous Air Quality Monitoring Station (DOE Photo Library)

particle pollution, both of which are associated with adverse health impacts.

Nitrogen oxides contribute to a wide range of environmental effects, including the formation of acid rain and potential changes in the composition and competition of some species of vegetation in wetland and terrestrial systems, visibility impairment, acidification of freshwater bodies, eutrophication of estuarine and coastal waters and increase in levels of toxins harmful to aquatic life.

### Ground Level Ozone (O<sub>3</sub>)

Ozone is not emitted directly into the air but is formed by the reaction of Volatile Organic Compounds (VOCs) and NO<sub>x</sub> in the presence of heat and sunlight. Ground-level ozone forms readily in the atmosphere, usually in the warm sunny urban atmosphere. VOCs are emitted from various sources, including motor vehicles, chemical plants, refineries, factories, consumer and commercial products, and other industrial sources. Nitrogen oxides are emitted from motor vehicles, power plants, and sources of combustion. Changes in weather patterns contribute to yearly differences in ozone concentrations. Ozone and the precursor pollutants that form ozone can also be transported hundreds of kilometres away depending on wind directions.



Photo 4: Industrial Air Pollution (DOE Photo Library)

Exposure to high concentrations of ground-level ozone has been linked to numerous health effects. Repeated exposure to ozone can make people more susceptible to respiratory infections resulting in lung inflammation and aggravate pre-existing respiratory diseases such as asthma.

Ozone also affects vegetation and ecosystems, leading to reduction in agricultural and commercial forest yields, reduced growth and survivability of tree seedlings, and increased plant susceptibility to diseases, pests, and other environmental stresses. In long-lived species, these effects may become evident only after several years or even decades. Thus ozone has the potential for long-term effect on forest ecosystems.

Figure 9 shows the annual average daily maximum one-hour ozone concentrations in ambient

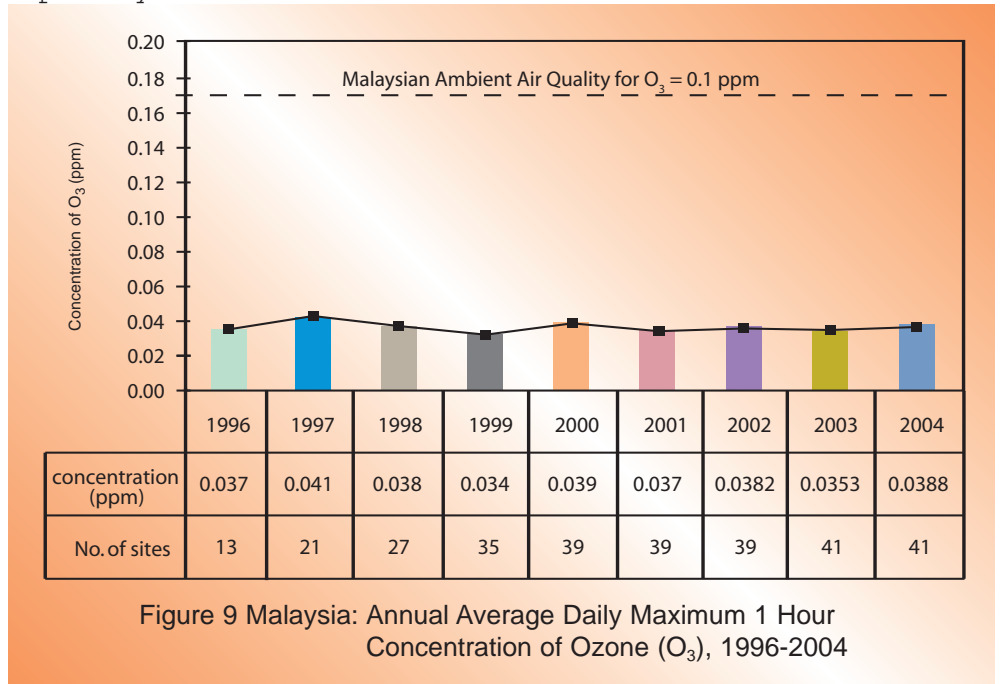


Figure 9 Malaysia: Annual Average Daily Maximum 1 Hour Concentration of Ozone (O<sub>3</sub>), 1996-2004

air for the years 1996 to 2004. There were fluctuations in the trend observed throughout this period. The highest level was recorded in 1997. This pattern can be explained by the meteorological conditions during that year when the whole region experienced prolonged dry and hot weather as a result of the El Nino phenomenon. In 2004, the annual average daily maxi-

## Carbon Monoxide (CO)

Carbon monoxide is a colourless, odourless and at high concentration, a poisonous gas. Carbon monoxide is formed when the carbon present in fuel is not burnt completely. CO is emitted mainly through motor vehicle exhaust. Other sources of CO emission include industrial processes and open burning activities. Carbon

monoxide enters the bloodstream through the lungs and reduces oxygen delivery to organs and tissues. The health threat from exposure to CO is most serious to those who suffer from cardiovascular diseases. At high levels of exposure, CO can be poisonous even for healthy people. Visual impairment, reduced work capacity and poor learning ability are among the health effects associated with exposure to elevated CO levels.

The annual eight-hourly average concentrations of carbon monoxide throughout the country measured from 1996 to 2004 were well below the Malaysian Ambient Air Quality Guideline (Figure 10). The concentration of CO was

consistently higher in urban areas where the main sources of emission were motor vehicles. Figure 10(a) shows CO concentrations for various categories of land use.

## Lead Concentration (Pb)

Excessive exposure to lead may cause neurological impairment such as mental retardation.

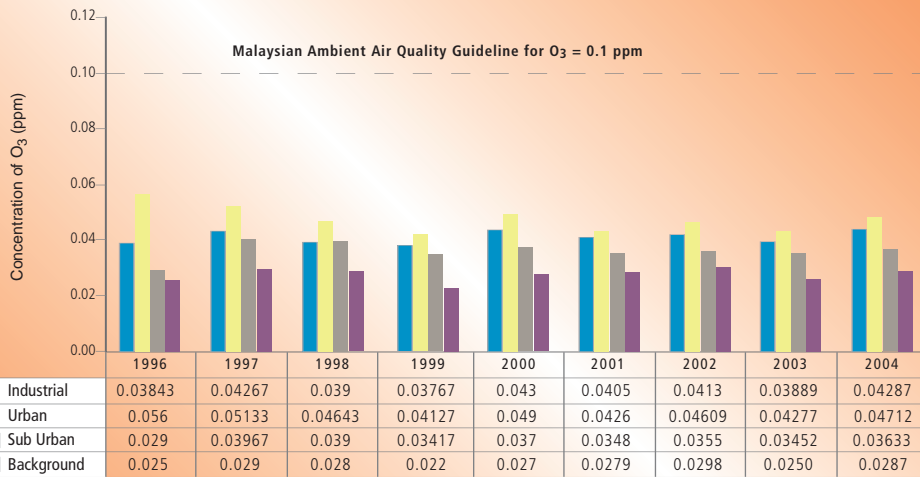


Figure 9(a) Malaysia: Annual Average Daily Maximum 1 Hour Concentration of Ozone (O<sub>3</sub>) by Land Use 1996-2004



Photo 5: Open Burning at Construction Site (DOE Photo Library)

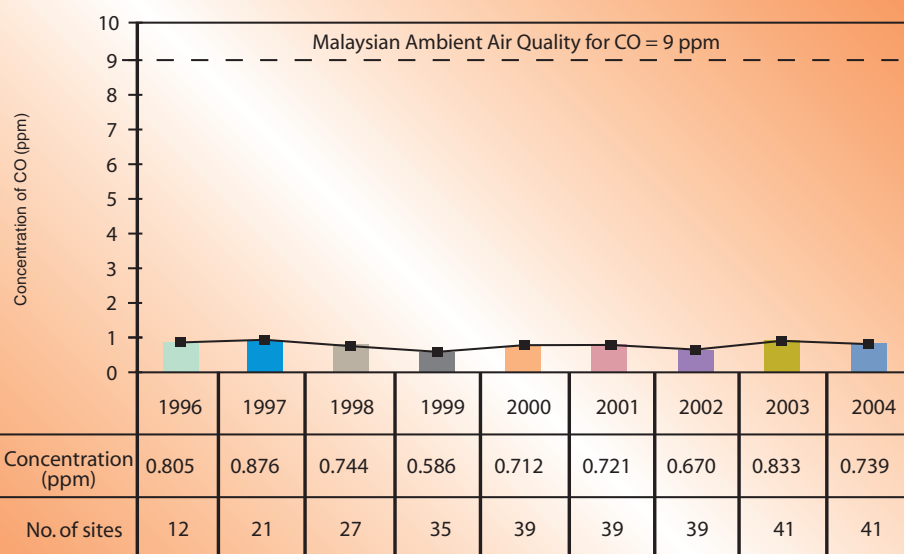


Figure 10 Malaysia: Annual Average Concentration of Carbon Monoxide (CO), 1996-2004



Photo 6: Open Burning at Illegal Solid Waste Dumping Site (DOE Photo Library)

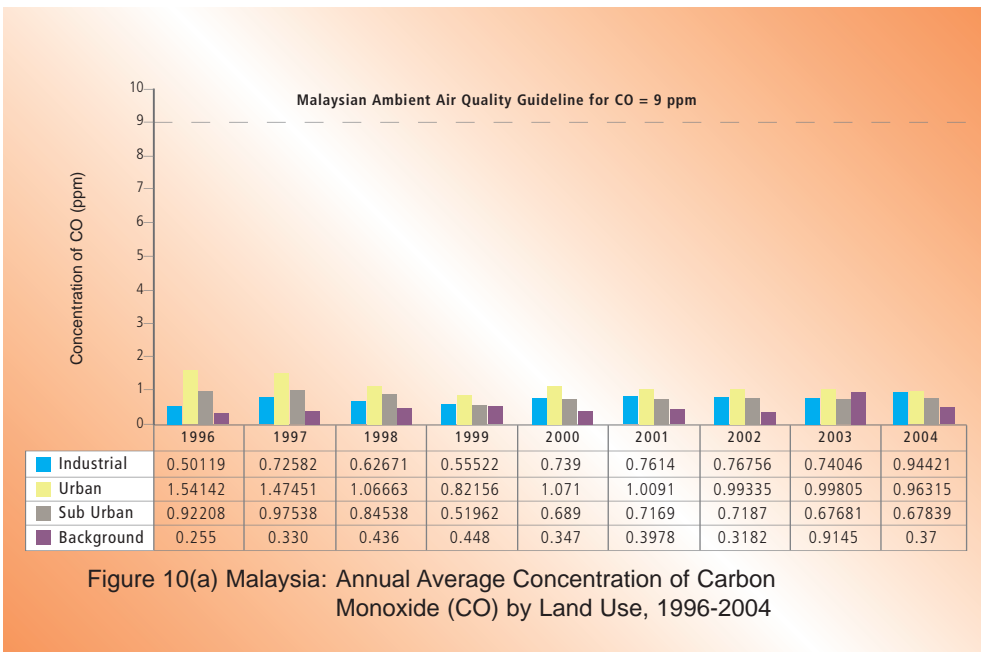


Figure 10(a) Malaysia: Annual Average Concentration of Carbon Monoxide (CO) by Land Use, 1996-2004

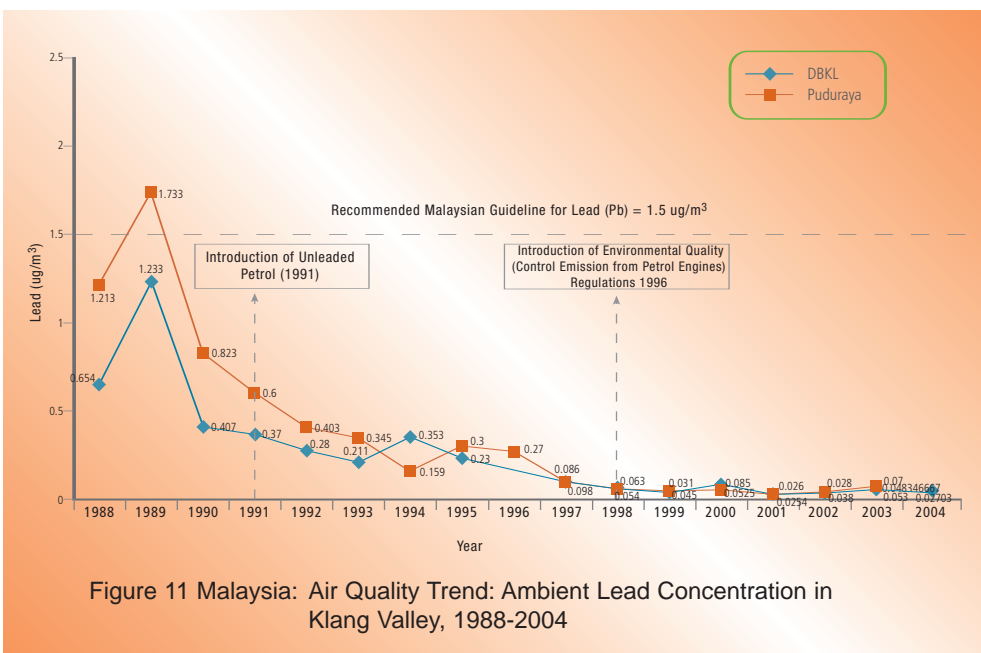


Figure 11 Malaysia: Air Quality Trend: Ambient Lead Concentration in Klang Valley, 1988-2004

In the past, motor vehicles were the main sources of Lead (Pb) emissions into the atmosphere. The lead levels monitored in the atmosphere were high in the eighties. However, as a result of Government efforts to promote the use of unleaded petrol in 1991 and the total phase-out of leaded petrol in 1998, the lead level in the atmosphere had declined significantly. In 2004, the average level of atmospheric lead monitored in the Klang Valley remained low as in previous years (Figure 11).





# Air Quality



# RIVER WATER QUALITY

## RIVER WATER QUALITY MONITORING

The importance of establishing baselines and detecting changes in river water quality prompted the Department of Environment (DOE) to begin its monitoring programme in 1978. This has since been extended to identifying pollution sources as well. Samples are regularly collected at predetermined stations for in-situ



Photo 7: Water Sampling at an Industrial Site (DOE Photo Library)



Photo 8: Sg Tuaran, (Sabah) (DOE Photo Library)

and laboratory analysis and data interpretation in terms of physico-chemical and biological characteristics. The Water Quality Index (WQI) used to appraise river water quality consists of parameters such as Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammoniacal Nitrogen ( $\text{NH}_3\text{N}$ ), Suspended Solids (SS) and pH. The WQI serves as a basis for environmental assessment of a watercourse in rela-



Photo 9: Water Sampling at a Polluted River near Industrial Site (DOE Photo Library)

## RIVER WATER QUALITY STATUS

In 2004, a total of 926 water quality monitoring stations located within 120 river basins were monitored (Map 2a, 2b & 2c). Out of these 926 monitoring stations, 540 (58%) were found to be clean, 278 (30%) slightly polluted and 108 (12%) polluted (Table 4(a), (b) and (c)). Stations located upstream were generally clean, while those downstream were either slightly polluted or polluted. In terms of river basin water quality, 58 rivers basins (48.3%) were clean compared to 59 river basins in 2003; 53 (44.1%) slightly polluted compared



Photo 8: Illegal Effluent Discharge from Factory Outlet (DOE Photo Library).

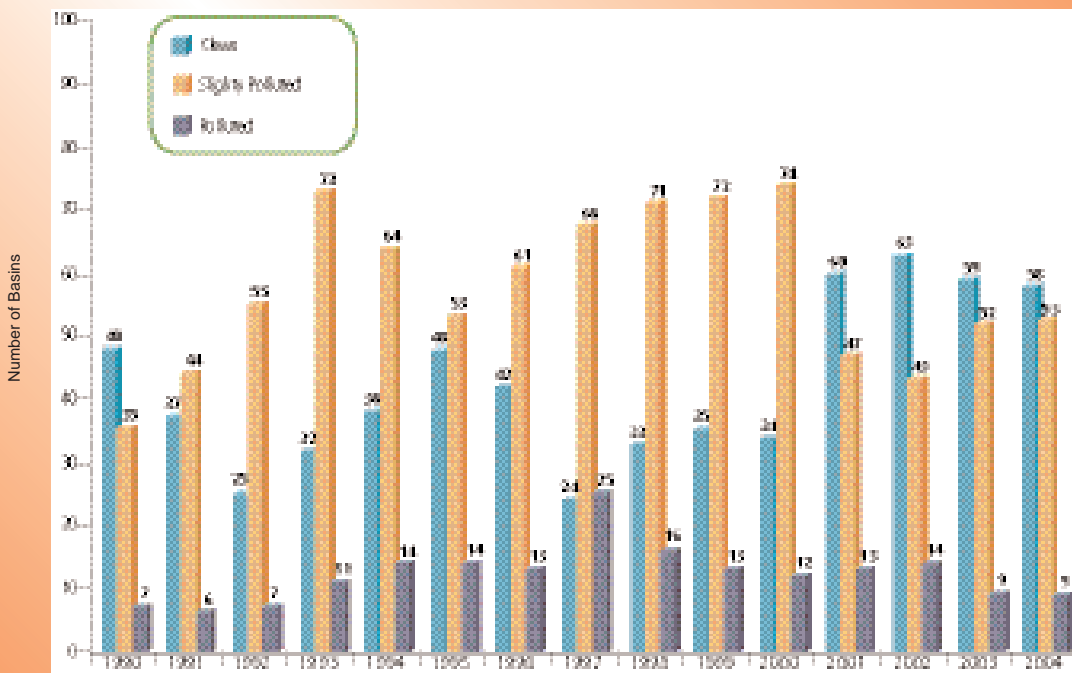


Figure 12 Malaysia: River Basins Water Quality Trend (1990 - 2004)



Photo 10: Water Pollution due to Oil and Grease Contamination (DOE Photo Library)

Cumulative water quality data compiled from 15 continuous water quality monitoring stations are presented in Figures 13, 14, 15 and 16. Based on the 90-percentile value, low dissolved oxygen levels were most frequent in Sg. Putat (34.8% Sat) followed by Sg. Klang (51.0% Sat) and Sg. Perai (53% Sat), (Figure 13). High

ammonium levels were recorded more frequently in Sg. Putat (7.7 mg/l) followed by Sg. Klang (7.1 mg/l) and Sg. Batang Benar (4.6 mg/l), (Figure 14). High turbidity level was most frequently detected in Sg. Klang (1190.1 NTU), followed by Sg. Langat (1023.3 NTU) and Sg. Rajang (782.8 NTU), (Figure 15).

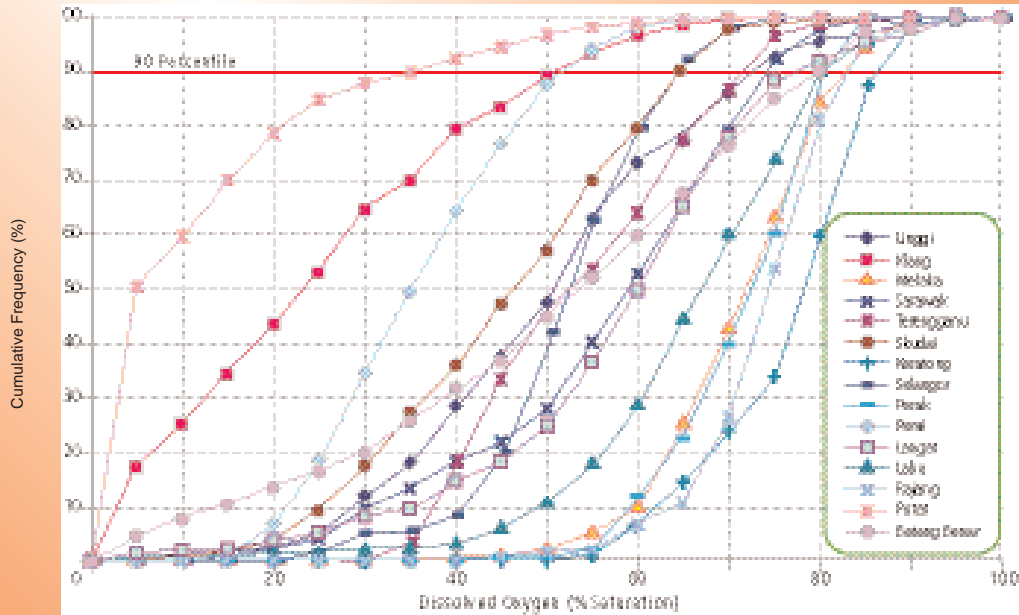


Figure 13 Malaysia: Cumulative Frequency for 15 CWQM Stations (Dissolved Oxygen), 2004

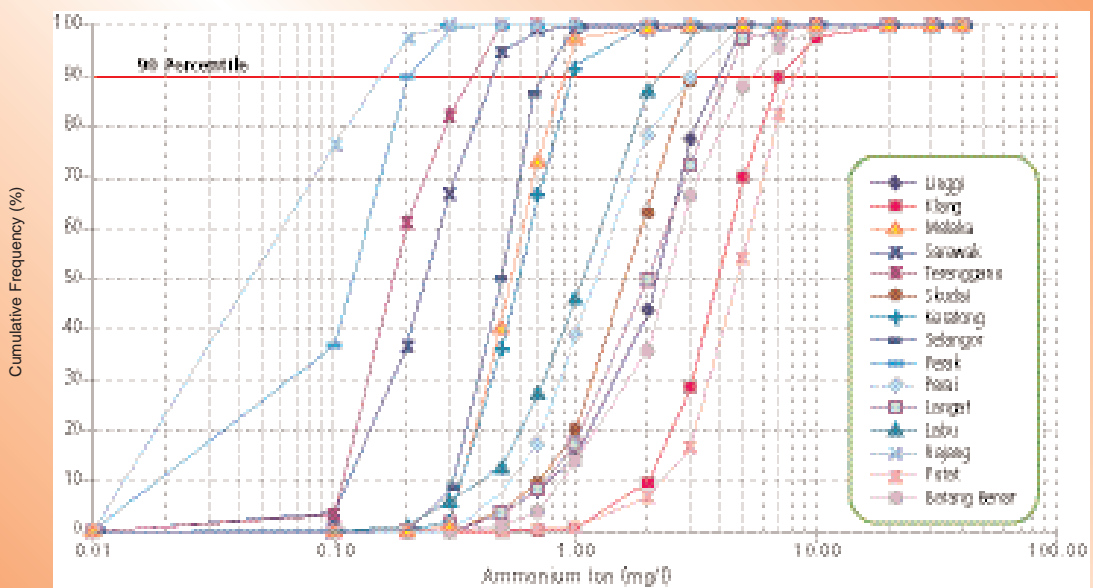


Figure 14 Malaysia: Cumulative Frequency for 15 CWQM Stations (Ammonium Ion Concentration), 2004

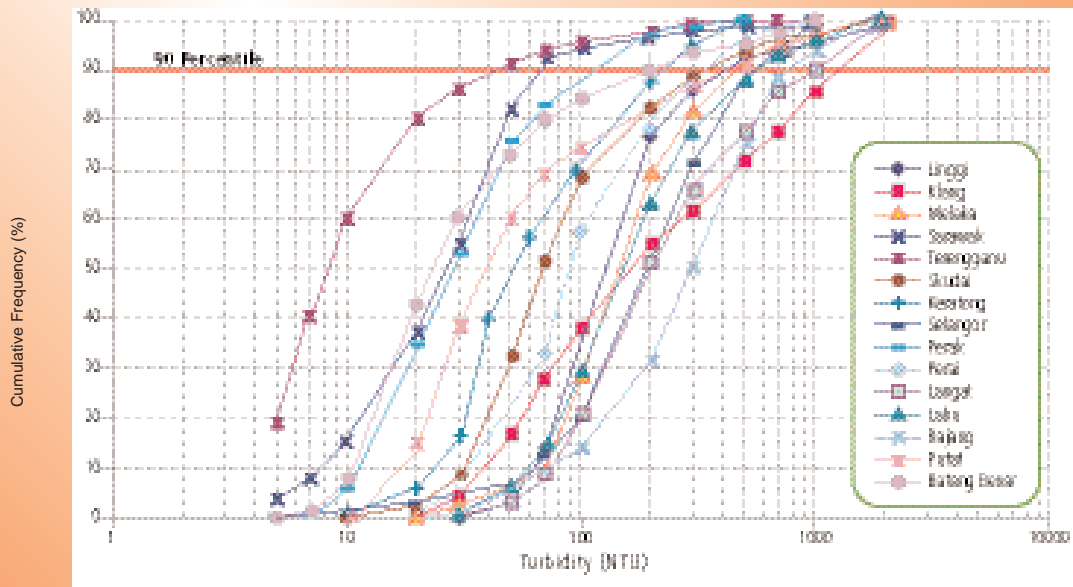


Figure 15 Malaysia: Cumulative Frequency for 15 CWQM Stations (Turbidity), 2004

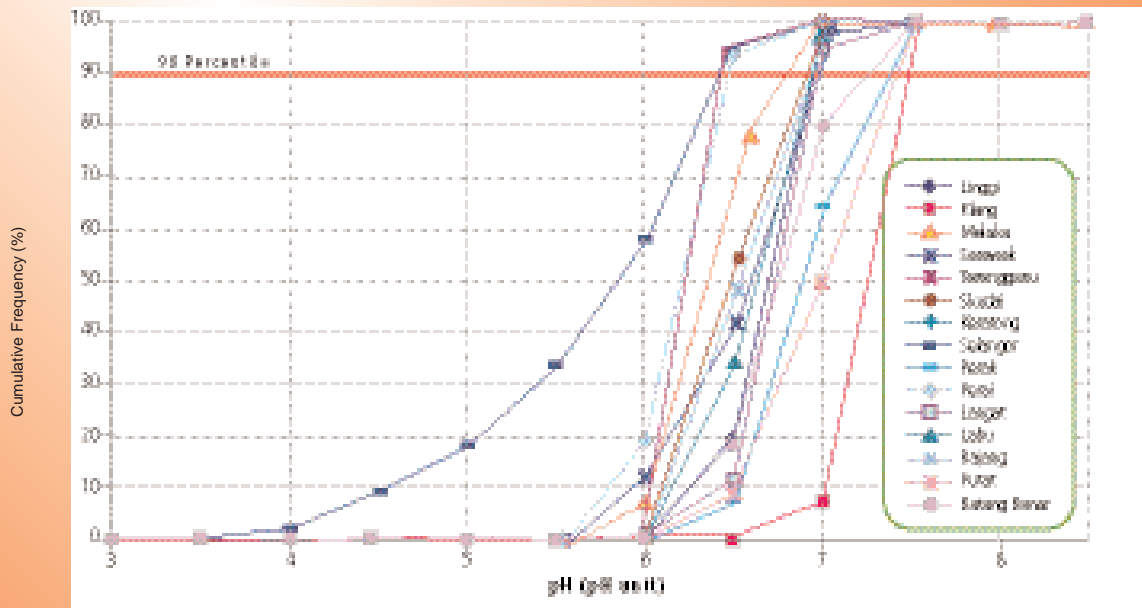


Figure 16 Malaysia: Cumulative Frequency for 15 CWQM Stations (pH Level), 2004

Continuous monitoring is vital for early detection of pollution influx. Over the years, a number of pollution incidences have been observed at many of the continuous monitoring stations. For the period January to December 2004, fifteen river water conditions exerting distinctive pollution influx were observed (Table 3).

Table 3 Malaysia: Pollution Influx Observed at Eleven Continuous Water Quality Monitoring Stations, 2004

Station	Date	Parameter	Potential Source
Sg. Labu	19 Jan	NH <sub>4</sub> : 3.45 mg/l Turbidity: 1454.13	Sewage or latex-based and industrial
Sg. Batang Benar	7 Jan	NH <sub>4</sub> : 6.83 mg/l pH: 9.81	Sewage or latex-based and industrial
Sg. Batang Benar	18 Feb	NH <sub>4</sub> : 6.53 mg/l	Sewage or latex-based
Sg. Batang Benar	25 Feb	NH <sub>4</sub> : 6.65 mg/l	Sewage or latex-based
Sg. Batang Benar	24 Mac	NH <sub>4</sub> : 7.35 mg/l	Sewage or latex-based
Sg. Langat	26 Mac	NH <sub>4</sub> : 6.78 mg/l DO: 1.34 mg/l	Sewage or latex-based
Sg. Putat	9 May	NH <sub>4</sub> : 8.47 Turbidity: 1369.25 Conductivity: 579.7 DO: 0.87 mg/l	Sewage and earthworks based
Sg Batang Benar	10 May	NH <sub>4</sub> : 19.42 mg/L	Sewage or latex-based and industrial
Sg Batang Benar	19 May	NH <sub>4</sub> : 9.35 mg/L DO: 0.00 mg/L	Sewage or latex-based and industrial
Sg Batang Benar	24 June	NH <sub>4</sub> : 8.11 mg/L DO: 0.15 mg/L	Sewage or latex-based
Sg Langat	22 Aug	NH <sub>4</sub> : 7.25 mg/L	Sewage or latex-based
Sg Putat	19 Sept	NH <sub>4</sub> : 8.41 mg/L Cond: 519.25 DO: 0.03 mg/L	Sewage or latex-based and industrial
Sg Skudai	24 Oct	NH <sub>4</sub> : 8.19 mg/L pH: 3.90	Sewage or industrial
Sg Putat	26 Dec	NH <sub>4</sub> : 10.43 mg/L DO: 0.75 mg/L	Sewage or latex-based
Sg Batang Benar	24 Dec	NH <sub>4</sub> : 4.44 mg/L DO: 0.68 mg/L	Sewage or latex-based

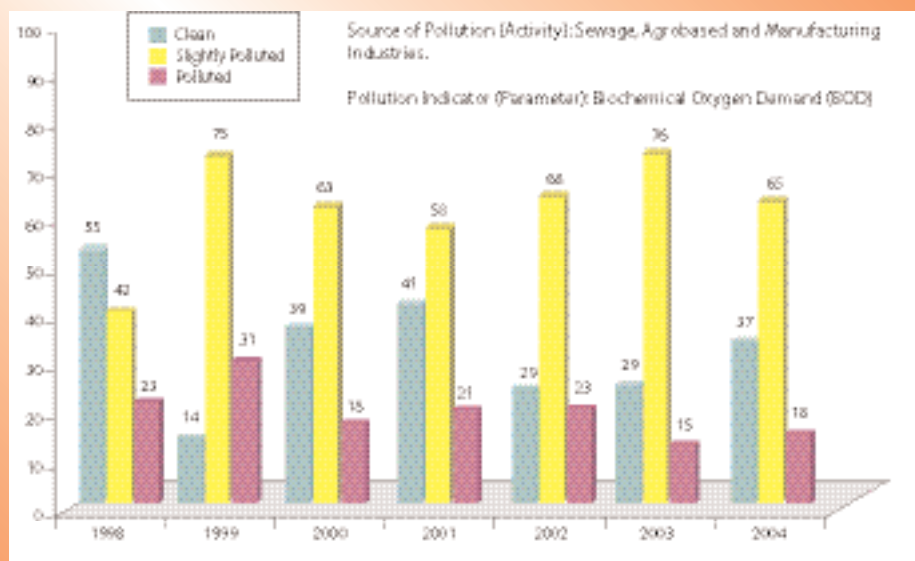


Figure 17 Malaysia: River Basins Water Quality Trend (BOD) 1998-2004

Figures 17, 18 and 19 illustrate the status of river water quality in relation to the major pollution sources. Based on Biochemical Oxygen Demand (BOD) level, 18 river basins were categorized as polluted, 37 river basins as slightly polluted and 65 river basins as clean (Figure 17). High BOD is contributed by untreated or partially treated sewage and discharges from agro-based and manufacturing industries. Based on Ammoniacal Nitrogen, 30 river basins were categorized as polluted, 47 river basins as slightly polluted and 43 river basins as clean (Figure 18). The main source of

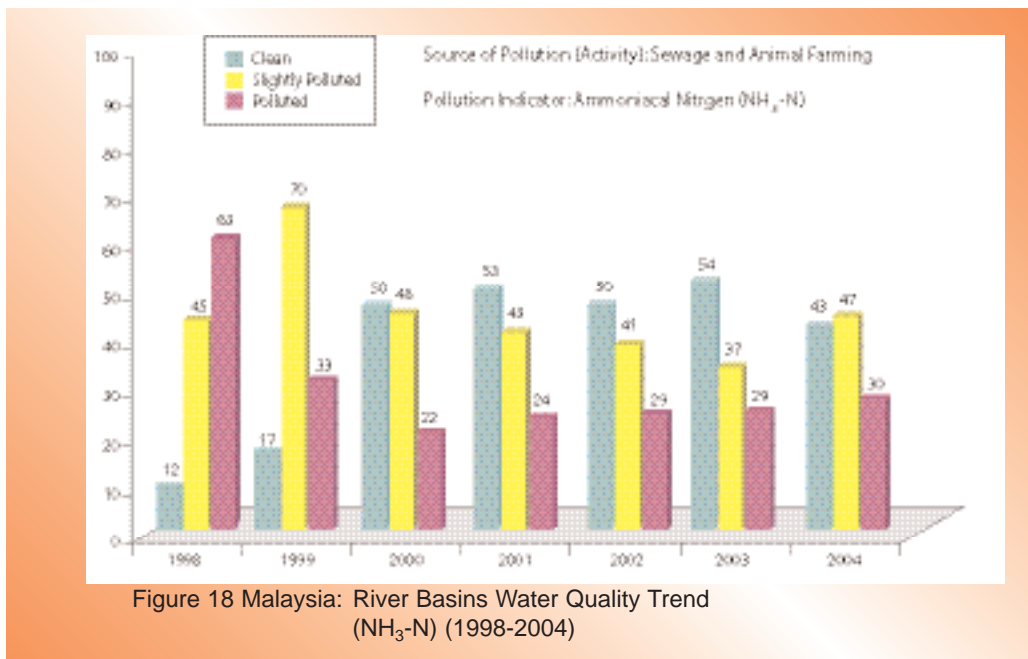


Figure 18 Malaysia: River Basins Water Quality Trend (NH<sub>3</sub>-N) (1998-2004)

of Ammoniacal Nitrogen (NH<sub>3</sub>-N) was sewage which include livestock farming and domestic sewage. Meanwhile, 31 river basins were categorized as polluted by suspended solids (SS), 11 river basins as slightly polluted and 78 river basins as clean (Figure 19). The sources for SS were earthworks and land-clearing activities.

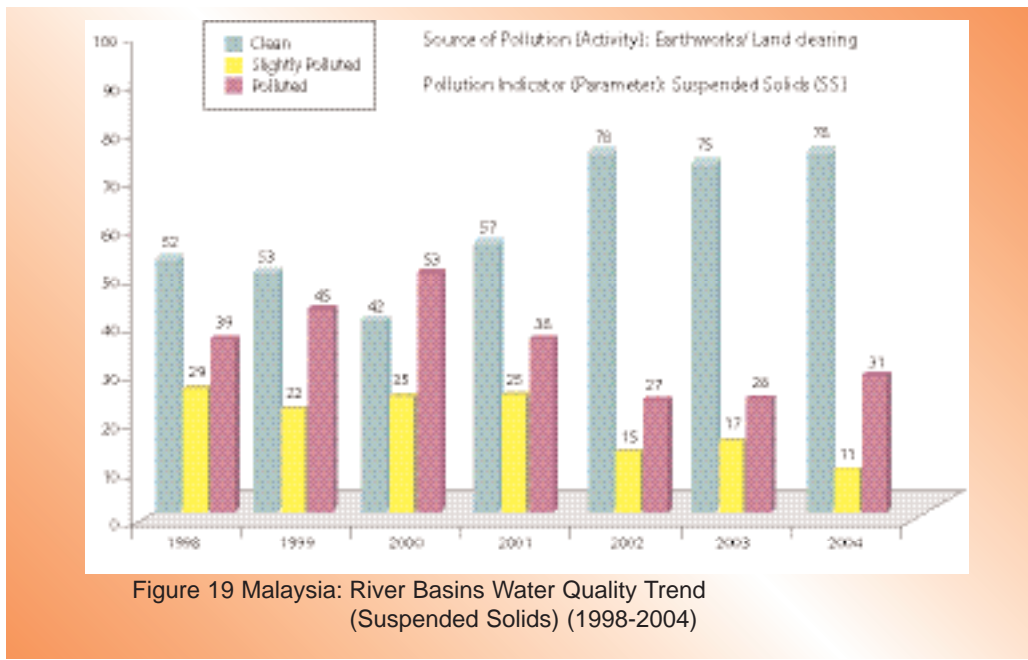


Figure 19 Malaysia: River Basins Water Quality Trend (Suspended Solids) (1998-2004)

with Class III, Interim National Water Quality Standards for arsenic (As), mercury (Hg), cadmium (Cd), chromium (Cr), lead (Pb) and zinc (Zn), except for iron (Fe) with 78% compliance and zinc (Zn) with 99% compliance.

The trend for river water quality status (1990-2004) is shown in Figure 12. A slight drop in river water quality occurred in 2004. While the number of polluted river basins

Analysis of heavy metals in 5,800 water samples revealed that almost all samples complied

The trend for river water quality status (1990-2004) is shown in Figure 12. A slight drop in river water quality occurred in 2004. While the number of polluted river basins

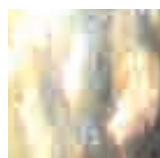
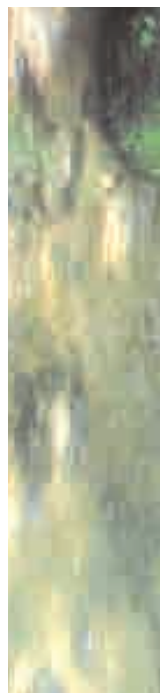


Table 4(a) Malaysia: Water Quality Status within Clean River Basin, 2004

STATE	CODE WQR	RIVER BASIN	NUMBER OF STATIONS	OVERALL WQI	RIVER	NUMBER OF RIVERS	WQI	RIVER STATUS	CLASS				
KEDAH	01PL	MELAKA	3	89 (87)	KISAP	1	92	C	II				
					MELAKA	1	82	C	II				
					PETANG	1	93	C	I				
KEDAH / P.PINANG	05	MUDA	9	84 (85)	JERUNG	2	70	SP	III				
					KETIL	1	91	C	II				
					MUDA	4	87	C	II				
					TAWAR	2	89	C	II				
PERAK	09	KURAU	5	82 (81)	ARA	1	91	C	II				
					KURAU	4	80	SP	II				
	10T	TEMERLOH	2	90 (89)	TEMERLOH	2	90	C	II				
					11	BERUAS	4	86 (84)	BRUAS	2	82	C	II
	ROTAN	2	89	C					II				
	13	PERAK	53	81 (80)	BATANG PADANG	3	87	C	II				
					BIDOR	3	85	C	II				
					CHENDERIANG	2	90	C	II				
					CUAR	2	91	C	II				
					KAMPAR	2	90	C	II				
					KANGSAR	2	90	C	II				
					KEPAYANG	2	70	SP	III				
					KERDAH	2	72	SP	III				
					KINTA	6	73	SP	III				
					KLAH	2	88	C	II				
					KLIAN BARU	2	75	SP	III				
					KUANG	1	85	C	II				
					PARI	2	69	SP	III				
					PELUS	2	85	C	II				
					PERAK	8	88	C	II				
					PINJI	2	60	SP	III				
					RAIA	2	88	C	II				
					SELUANG	1	76	SP	III				
SEROKAI	2	64	SP	III									
SUNGKAI	2	89	C	II									
SUNGKAI MATI	2	71	SP	III									
TUMBOH	1	72	SP	III									
SELANGOR	16	SELANGOR	9	85 (84)	BATANG KALI	1	92	C	II				
					KANCING	1	89	C	II				
					KERLING	1	92	C	II				
					SELANGOR	4	83	C	II				
					SEMBAH	1	68	SP	III				
					SERENDAH	1	88	C	II				
JOHOR/ NEGERI SEMBILAN	25	MUAR	43	81 (81)	GEMENCHEH	3	89	C	II				
					JUASSEH	2	87	C	II				
					KELAMAH	2	76	SP	III				
					LABIS	4	82	C	II				
					MERBUDU	1	69	SP	III				
					MERLIMAU	1	73	SP	III				
					MUAR	16	82	C	II				
					P. MENKUANG	1	86	C	II				
					PALONG	4	84	C	II				
					SEGAMAT	1	87	C	II				
					SENARUT	2	77	SP	II				
					SEROM	1	63	SP	III				
					SPG. LOI	2	80	SP	II				
					TEMARONG	1	92	C	II				
					TENANG	2	76	SP	III				
					29	JOHOR	44	81 (80)	ANAK SG. SAYONG	3	66	SP	III
									BERANGAN	2	82	C	II
									BKT. BESAR	2	70	SP	III
	CHEMANGAR	1	80	SP					II				
	JOHOR	4	87	C					II				
	LAYANG	1	92	C					II				
	LAYAU KIRI	2	85	C	II								
	LEBAM	2	84	C	II								
LINGGIU	1	88	C	II									
PENGGELI	2	90	C	II									

Table 4(a) Malaysia: Water Quality Status within Clean River Basin, 2004 (Continued)

STATE	CODE WQR	RIVER BASIN	NUMBER OF STATIONS	OVERALL WQI	RIVER	NUMBER OF RIVERS	WQI	RIVER STATUS	CLASS
JOHOR	30A	SEDILI BESAR	13	83 (84)	REMIS	2	88	C	II
					SANTI	1	83	C	II
					SAYONG	4	87	C	II
					SAYONG	4	87	C	II
					SEBOL	2	81	C	II
					SEMANGER	1	87	C	II
					SEMENCHU	2	82	C	II
					SENING	2	74	SP	III
					SERAI	2	71	SP	III
					TELOR	2	90	C	II
					TEMON	2	87	C	II
					TIRAM	4	76	SP	III
					AMBAT	2	87	C	II
					DOHOL	1	86	C	II
					MUPUR	1	59	P	III
					SEDILI BESAR	5	81	C	II
SEMANGGOT KANAN	1	89	C	II					
SEMANGGOT KIRI	1	89	C	II					
TEMUBOR KANAN	2	87	C	II					
PAHANG	31A	MERSING	1	90 (91)	MERSING	1	90	C	II
	31B	JEMALUANG	2	84 (80)	JEMALUANG	2	84	C	II
PAHANG	32AE	ANAK ENDAU	2	86 (87)	ANAK ENDAU	2	86	C	II
					ROMPIN	18	85 (85)	AUR	1
	34	BEBAR/MERCHONG	8	83 (83)	BAKAR	1	65	SP	III
					JEKATIH	2	90	C	II
					JERAM	1	90	C	II
					KEPASING	1	75	SP	III
					KERATONG	4	88	C	II
					PUKIN	3	89	C	II
					REKOH	1	82	C	II
					ROMPIN	4	85	C	II
					BEBAR	1	83	C	II
					KELAYAT	1	89	C	II
					MERBA	1	88	C	II
	MERCHONG	1	69	SP	III				
	SERAI	2	91	C	II				
	TEMIANG	2	75	SP	III				
	35B	BERA	5	85 (85)	BERA	3	84	C	II
					TASIK BERA	1	87	C	II
	35CH	BERTAM	10	89 (85)	TRIANG	1	86	C	II
					BERTAM	2	86	C	II
					BURUNG	1	92	C	II
					HABU	1	90	C	II
					LENGGOK	1	92	C	II
					RINGLET	1	90	C	II
					TELOM	2	89	C	II
	TERLA	1	88	C	II				
	35L	LEPAR	10	87 (87)	TRINGKAP	1	89	C	II
					ANAK SG. LEPAR	1	73	SP	III
					BELAYAR	1	91	C	II
					BERKAPOR	2	85	C	II
					CHINI	1	84	C	II
					LEPAR	3	90	C	II
					T. PAYA BUNGOR	1	90	C	II
35M	MENTIGA	2	88 (84)	TASIK CHINI	1	90	C	II	
35P	PAHANG	53	88 (88)	MENTIGA	2	88	C	II	
				BATU	1	73	SP	III	
				BENTONG	4	87	C	II	
				BENUS	2	90	C	II	
				BILUT	1	88	C	II	
				JELAI	2	87	C	II	
				JEMPOL	2	90	C	II	
				JENGA	2	85	C	II	
				KELAU	2	89	C	II	
				KERTAM	1	84	C	II	
				KOYAN	1	91	C	II	
				KUNDANG	1	81	C	II	

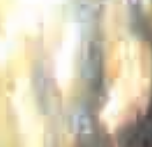


Table 4(a) Malaysia: Water Quality Status within Clean River Basin, 2004 (Continued)

STATE	CODE WQR	RIVER BASIN	NUMBER OF STATIONS	OVERALL WQI	RIVER	NUMBER OF RIVERS	WQI	RIVER STATUS	CLASS
TERENGGANU					LIPIS	3	90	C	II
					LUIT	1	89	C	II
					MARAN	2	87	C	II
					PAHANG	9	88	C	II
					PENJURING	1	93	C	I
					PERTANG	2	88	C	II
					PERTING	1	91	C	II
					SEMANTAN	3	88	C	II
					SERTING	2	81	C	II
					SIAM	1	90	C	II
					TANGLIR	1	90	C	II
					TEKAL	1	82	C	II
					TEKAM	2	90	C	II
					TELANG	1	90	C	II
	TELEMONG	2	89	C	II				
	TERANUM	1	94	C	I				
	TERAS	1	93	C	I				
	37	BALOK/TONGGOK	5	81 (79)	BALOK	2	76	SP	III
	37A	CERATING	1	82 (79)	TONGGOK	3	84	C	II
	37A	CERATING	1	82 (79)	CERATING	1	82	C	II
	39K	KERTIH	2	86 (88)	KERTIH	2	86	C	II
	40	PAKA	10	85 (85)	BESUL	2	90	C	II
					PAKA	4	87	C	II
					RASAU	2	85	C	II
					RENGAT	2	78	SP	II
	41	DUNGUN	4	87 (89)	DUNGUN	2	88	C	II
	42M	MARANG	5	84 (84)	TELEMBOH	2	86	C	II
					KERAK	2	77	SP	II
					MARANG	1	90	C	II
	43	TERENGGANU	9	85 (87)	TEMALA	2	89	C	II
					BERANG	2	90	C	II
					NERUS	3	89	C	II
					PUEH	2	78	SP	II
					TERENGGANU	2	83	C	II
	44	SETIU	3	88 (84)	SETIU	1	91	C	II
	46	BESUT	4	88 (89)	TAROM	2	87	C	II
					BESUT	2	91	C	II
					JERTIH	2	85	C	II
47K	KEMASIN	1	84 (83)	KEMASIN	1	84	C	II	
48	KELANTAN	38	87 (88)	ARING	2	86	C	II	
				BELATOP	2	80	SP	II	
				BER	1	89	C	II	
				BEROK	2	86	C	II	
				BETIS	1	89	C	II	
				CHIKU	2	90	C	II	
				GALAS	1	89	C	II	
				KELANTAN	4	86	C	II	
				KELESA	2	91	C	II	
				KERAK	2	89	C	II	
				KERILLA	2	92	C	II	
				KETIL	2	90	C	II	
				NAL	3	90	C	II	
				PEHI	2	91	C	II	
				PENGKALAN CHEPA	1	77	SP	II	
				PENGKALAN DATU	3	80	SP	II	
				PERGAU	2	91	C	II	
				PERTOK	2	86	C	II	
				RELAI	2	88	C	II	
49	GOLOK	4	87 (89)	GOLOK	2	87	C	II	
				TASIK GARU	2	87	C	II	
50	KAYAN	4	84 (85)	KAYAN	3	82	C	II	
52	SADONG	6	81 (81)	SEMATAN	1	91	C	II	
				KARANGAN	1	78	SP	II	
				SADONG	3	77	SP	II	
				TARAT	2	89	C	II	
56	RAJANG	18	83 (82)	BINATANG	1	91	C	II	

Table 4(a) Malaysia: Water Quality Status within Clean River Basin, 2004 (Continued)

STATE	CODE WQR	RIVER BASIN	NUMBER OF STATIONS	OVERALL WQI	RIVER	NUMBER OF RIVERS	WQI	RIVER STATUS	CLASS				
SABAH	60	TATAU	1	85 (76)	JULAU	1	90	C	II				
					MERADONG	1	86	C	II				
					RAJANG	14	81	C	II				
					SARIKEI	1	84	C	II				
					TATAU	1	85	C	II				
					62	SIMILAJAU	1	82 (88)	SIMILAJAU	1	82	C	II
									SUAI	1	82	C	II
					63	SUAI	1	82 (78)	SUAI	1	82	C	II
					65	KABULOH	6	81 (77)	KABULOH	2	77	SP	II
									KEJAPIL	1	87	C	II
									SATAP	1	82	C	II
									SIBUTI	2	82	C	II
									LIMBANG	5	81 (83)	C	II
									TRUSAN	1	86 (81)	C	II
	70	LAWAS	2	87 (88)	LAWAS	2	87	C	II				
	71	MENGGALONG	3	90 (88)	LAKUTAN	1	89	C	II				
					LINGKUNGAN	1	91	C	II				
					MENGGALONG	1	89	C	II				
					72	PADAS	7	90 (90)	BUNSI	1	91	C	II
									LIAWAN	1	94	C	I
									PADAS	3	88	C	II
									PANGATAN	1	86	C	II
									TANDULU	1	93	C	I
									MEMBAKUT	1	91	C	II
									PAPAR	2	92	C	II
					77	DAMIT/TUARAN	6	90 (90)	DAMIT	2	89	C	II
	SONG SAI	1	92	C					II				
	TUARAN	3	90	C					II				
	78	KEDAMAIAN	3	90 (91)	TEMPASUK	2	92	C	II				
					TENGHILAN	1	87	C	II				
					BENGGOKA	1	91	C	II				
	80	BENGGOKA	1	91 (83)	BENGGOKA	1	91	C	II				
					83	SUGUT	6	91 (92)	BONGKUD	1	90	C	II
	LOHAN	2	91	C					II				
	MERALI	1	91	C					II				
	SUGUT	2	92	C					II				
	84	LABOK	8	88 (89)					KINIPIR	2	86	C	II
									LIWAGU	2	88	C	II
					MALIAU	1	93	C	I				
					SAPI	2	84	C	II				
					SUALONG	1	93	C	I				
	86	KINABATANGAN	4	81 (82)	KINABATANGAN	2	82	C	II				
					KOYAH	1	83	C	II				
					TENEGANG BESAR	1	77	SP	II				
	87	SEGAMA	1	85 (87)	SEGAMA	1	85	C	II				
	88	SILABUKAN	2	81 (80)	SILABUKAN	2	81	C	II				
	89	TINGKAYU	1	85 (81)	TINGKAYU	1	85	C	II				
91	TAWAU	5	84 (86)	APAS	1	91	C	II					
				BALUNG	1	86	C	II					
				TAWAU	3	80	SP	II					
93	UMAS-UMAS	1	82 (86)	UMAS-UMAS	1	82	C	II					
94	BRANTIAN	1	81 (86)	BRANTIAN	1	81	C	II					

- NOTE:
1. WQI BASED ON 6 MAJOR PARAMETERS: BOD, COD, SS, pH, DO, NH<sub>3</sub>-N
  2. RIVER WATER QUALITY STATUS: C: CLEAN, SP: SLIGHTLY POLLUTED, P: POLLUTED
  3. RIVER CLASS BASED ON INWQS
  4. ( ) Overall WQI for 2003
  5. OVERALL WQI FOR RIVER BASIN IS CALCULATED BY AVERAGING WQI FROM ALL SAMPLING STATIONS IN EACH BASIN THROUGHOUT THE YEAR

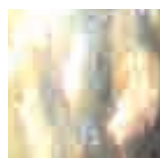
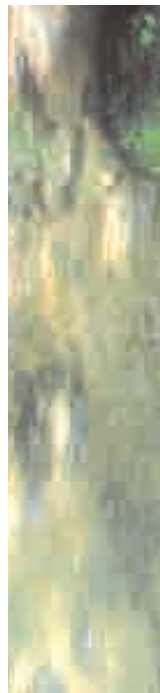


Table 4(b) Malaysia: Water Quality Status within Slightly Polluted River Basin, 2004

STATE	CODE WQR	RIVER BASIN	NUMBER OF STATIONS	OVERALL WQI	RIVER	NUMBER OF RIVERS	WQI	RIVER STATUS	CLASS
PERLIS	1	PERLIS	10	78 (77)	ARAU	1	67	SP	III
					JARUM	1	81	C	II
					JERNIH	2	76	SP	III
					KOK MAK	1	79	SP	II
					NGULANG	1	82	C	II
					PERALIT	1	88	C	II
					PERLIS	1	71	SP	III
					SERAI	1	84	C	II
					TASOH	1	79	SP	II
					KEDAH	03	KEDAH	6	79 (82)
					PADANG TERAP	3	81	C	II
					PEDU	1	86	C	II
					TEKAI	1	83	C	II
KEDAH	04	MERBOK	10	65 (64)	BAKAR ARANG	1	58	P	III
					BATU	1	38	P	IV
					BONGKOK	1	74	SP	III
					BUKIT MERAH	1	80	SP	II
					KOROK	1	58	P	III
					MERBOK	1	74	SP	III
					PETANI	1	56	P	III
					TOK PAWANG	2	75	SP	III
					TUPAH	1	61	SP	III
					P. PINANG/ KEDAH	06P	PERAI	22	63 (66)
JARAK	6	69	SP	III					
KELADI	1	76	SP	III					
KEREH	4	54	P	III					
KUBANG SEMANG	2	59	P	III					
KULIM	3	87	C	II					
PERAI	2	67	SP	III					
SELUANG	1	58	P	III					
SELUANG BAWAH	2	58	P	III					
P. PINANG/ PERAK	08	KERIAN	10	76 (75)					
					KERIAN	4	79	SP	II
					SELAMA	2	70	SP	III
					SERDANG	1	64	SP	III
					PERAK	10	SEPETANG	10	75 (75)
JANA	1	91	C	II					
LARUT	1	67	SP	III					
LIDIN	1	61	SP	III					
MALAI	1	60	SP	III					
SEPETANG	3	78	SP	II					
TUPAI	1	84	C	II					
12	RAJA HITAM/ MANJONG	6	73 (68)	DERHAKA		2	61	SP	III
				MANJONG		2	81	C	II
				RAJA HITAM		2	76	SP	III
12W	WANGI/DERALIK	4	69 (64)	DERALIK	2	76	SP	III	
				WANGI	2	62	SP	III	
PERAK/ SELANGOR	14	BERNAM	10 79	(80)	BERNAM	6	74	SP	III
					SLIM	2	89	C	II
					TEROLAK	2	87	C	II
SELANGOR	15	TENGI	2	78 (79)	TENGI	2	78	SP	II
					ANAK CHUAU	1	80	SP	II
	19	LANGAT	28	70 (71)	BALAK	1	60	SP	III
					BATANG BENAR	2	58	P	III
					BATANG LABU	2	75	SP	III
					BATANG NILAI	2	49	P	IV
					BERANANG	1	83	C	II
					BUAN	1	70	SP	III
					CHUAU	2	89	C	II
					JIJAN	1	85	C	II
					LANGAT	8	68	SP	III
					LIMAU MANIS	1	76	SP	III
					LUI	1	89	C	II

Table 4(b) Malaysia: Water Quality Status within Slightly Polluted River Basin, 2004 (Continued)

STATE	CODE WQR	RIVER BASIN	NUMBER OF STATIONS	OVERALL WQI	RIVER	NUMBER OF RIVERS	WQI	RIVER STATUS	CLASS					
NEGERI SEMBILAN	20	SEPANG	3	72 (74)	PAJAM	1	78	SP	II					
					RINCHING	1	77	SP	II					
					SEMENYIH	3	82	C	II					
					SEPANG	3	72	SP	III					
	20J 21	LUKUT LINGGI	15	75 (74) 77 (76)	LUKUT	1	75	SP	III					
					BATANG PENAR	1	55	P	III					
					CHEMBONG	1	84	C	II					
					KEPAYONG	1	75	SP	III					
					KUNDUR BESAR	1	92	C	II					
					LINGGI	6	74	SP	III					
					PEDAS	1	87	C	II					
					REMBAU	2	83	C	II					
					SIMIN	1	70	SP	III					
					TEMIANG	1	77	SP	II					
					MELAKA	22	MELAKA	17	73 (73)	BTG.MELAKA	2	87	C	II
DURIAN TUNGGAL	1	83	C	II										
MELAKA	9	71	SP	III										
PUTAT	2	59	P	III										
REMBIA	2	77	SP	II										
TAMPIN	1	87	C	II										
23 24	DUYONG KESANG/MERLIMAU	3 8	76 (72) 71 (71)	DUYONG		3	76	SP	III					
				CHOHONG		2	85	C	II					
				KESANG		3	79	SP	II					
				MERLIMAU		3	54	P	III					
				JOHOR		26	BATU PAHAT	23	75 (75)	AMRAN	2	72	SP	III
										BATU PAHAT	1	60	SP	III
BEKOK	4	80	SP		II									
BERLIAN	2	82	C		II									
CHAAH	2	87	C		II									
LENIK	1	82	C		II									
MEREK	2	86	C		II									
MERPO	2	85	C		II									
SEMBERONG	2	63	SP		III									
SIMPANG KANAN	2	58	P		III									
SIMPANG KIRI	3	67	SP		III									
AIR BALOI	3	67	SP		III									
BENUT	4	74	SP		III									
27A 27B	AIR BALOI BENUT	3 7	67 (54) 74 (77)		PT. HAJI YASSIN	2	73	SP	III					
					ULU BENUT	1	78	SP	II					
					AIR HITAM	1	66	SP	III					
					AYER MERAH	1	55	P	III					
					PONTIAN BESAR	3	74	SP	III					
28A	PONTIAN BESAR	5	68 (61)		AIR HITAM	1	66	SP	III					
					AYER MERAH	1	55	P	III					
28B 28C	PONTIAN KECIL SKUDAI	2 11	75 (75) 65 (70)		PONTIAN BESAR	3	74	SP	III					
					PONTIAN KECIL	2	75	SP	III					
					MELANA	2	59	P	III					
28D	TEBRAU	5	68 (77)		SKUDAI	9	66	SP	III					
					PLENTONG	1	49	P	IV					
					TEBRAU	4	73	SP	III					
				RAMBAH	2	70	SP	III						
28G 30B	RAMBAH SEDILI KECIL	2 5	70 (63) 71 (74)	ANAK SEDILI KECIL	1	37	P	IV						
				BAHAN	2	82	C	II						
30C 32	PALOI ENDAU	2 29	80 (82) 78 (79)	SEDILI KECIL	2	78	SP	II						
				PALOI	2	82	C	II						
A.S. SEMBERONG	2	2	82	DENGAR	2	84	C	II						
				ENDAU	1	86	C	II						
				JEBONG	1	69	SP	III						
				LENGA	2	64	SP	III						
				LENGGOR	2	83	C	II						
				MAMAI	2	83	C	II						
				MELANTAI	2	69	SP	III						
				MENGKIBOL	3	81	C	II						
				PALOH	2	83	C	II						
				PAMOL	1	39	P	IV						
				SEMBERONG	5	82	C	II						
				SINGOL	2	77	SP	II						
				TAMOK	2	89	C	II						



Table 4(b) Malaysia: Water Quality Status within Slightly Polluted River Basin, 2004 (Continued)

STATE	CODE WQR	RIVER BASIN	NUMBER OF STATIONS	OVERALL WQI	RIVER	NUMBER OF RIVERS	WQI	RIVER STATUS	CLASS				
PAHANG	32/33	PONTIAN	3	80 (80)	PONTIAN	2	89	C	II				
		SEPAYANG	1		62	SP	III						
	35	SERTING	5	79 (78)	MOKEK	2	83	C	II				
		SERTING	3		76	SP	III						
	36	KUANTAN	11	79 (81)	BELAT	1	87	C	II				
					CHARU	1	89	C	II				
					GALING BESAR	1	47	P	IV				
					GALING KECIL	1	52	P	III				
					KENAU	1	87	C	II				
					KUANTAN	4	88	C	II				
					PINANG	1	77	SP	II				
					RIAU	1	79	SP	II				
	TERENGGANU	38	KEMAMAN	10	79 (81)	CHERUL	2	89	C	II			
KEMAMAN						2	89	C	II				
NERAM						2	82	C	II				
PERASING						2	88	C	II				
39C		CHUKAI	5	78 (79)	RANSAN	2	48	P	IV				
					CHUKAI	1	89	C	II				
					IBOK	2	84	C	II				
42I		IBAI	3	75 (82)	RUANG	2	66	SP	III				
					IBAI	3	75	SP	III				
42L		LANDAS	2	71 (60)	LANDAS	2	71	SP	III				
KELANTAN SARAWAK	47S	SEMERAK	2	78 (78)	SEMERAK	2	78	SP	II				
		SARAWAK	15	79 (80)	KUAP	2	75	SP	III				
	51BS	SAMARAHAN LUPAR	7	80 (82)	MAONG KIRI	1	55	P	III				
					SANTUBONG	1	86	C	II				
					SARAWAK	6	86	C	II				
					SARAWAK KANAN	1	87	C	II				
					SARAWAK KIRI	1	92	C	II				
					SEMENGGOH	2	68	SP	III				
					TABUAN	1	79	SP	II				
					SAMARAHAN	2	77	SP	II				
					AI	1	87	C	II				
					LUPAR	3	74	SP	III				
					SEKERANG	1	88	C	II				
					SETERAP	1	80	SP	II				
					UNDUP	1	86	C	II				
					54	SARIBAS	2	80 (82)	RIMBAS	1	91	C	II
									SARIBAS	1	69	SP	III
	55	KERIAN	3	79 (81)	KERIAN	2	77	SP	II				
					SEBLAK	1	82	C	II				
	57	OYA	3	75 (75)	OYA	3	75	SP	III				
	58	MUKAH	4	75 (77)	MUKAH	4	75	SP	III				
	59	BALINGIAN	2	78 (80)	BALINGIAN	2	78	SP	II				
	61	KEMENA	3	80 (81)	KEMENA	2	80	SP	II				
					SIBIU	1	80	SP	II				
	64	NIAH	5	77 (73)	NIAH	2	82	C	II				
					SEKALOH	3	73	SP	III				
	66	MIRI/LUTONG	7	68 (66)	ADONG	1	62	SP	III				
					DALAM	1	63	SP	III				
					LUTONG	2	75	SP	III				
					MIRI	2	69	SP	III				
PADANG LIKU					1	72	SP	III					
67	BARAM	4	76 (75)	BARAM	4	76	SP	III					
SABAH	76	MOYOG	11	79 (79)	INANAM	3	81	C	II				
					LIKAS	1	53	P	III				
					MENGGATAL	2	83	C	II				
					MOYOG	3	91	C	II				
					TELIPOK	2	65	SP	III				
	79	BINGKONGAN	3	64 (68)	BANDAU	1	87	C	II				
					MENGGARIS	1	25	P	V				
	85	KAYA	1	79 (84)	TANDEK	1	82	C	II				
					MOUNAD	1	79	SP	II				
					INTAN	1	84	C	II				
90	KALUMPANG	5	70 (77)										

Table 4(b) Malaysia: Water Quality Status within Slightly Polluted River Basin, 2004 (Continued)

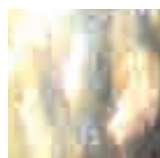
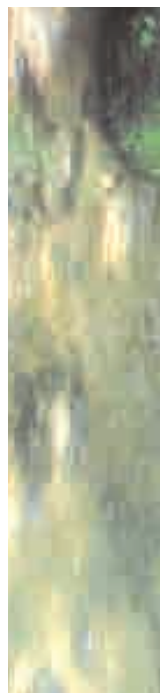
STATE	CODE WQR	RIVER BASIN	NUMBER OF STATIONS	OVERALL WQI	RIVER	NUMBER OF RIVERS	WQI	RIVER STATUS	CLASS
					KALUMPANG	2	86	C	II
					PANG BURONG 1	1	46	P	IV
					PANG BURONG 2	1	52	P	III
	95	KALABAKAN	2	78 (78)	KALABAKAN	2	78	SP	II

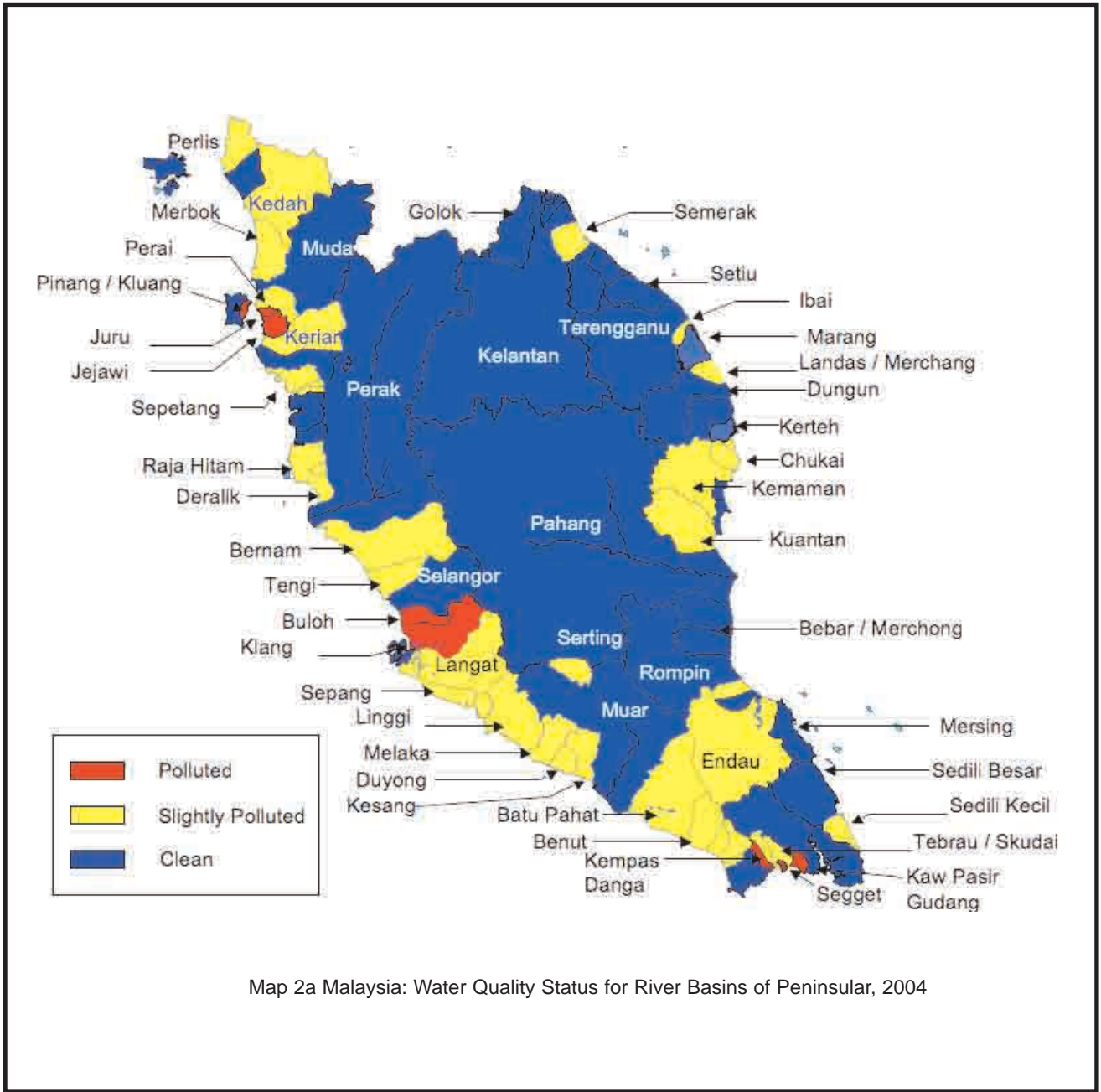
- NOTE: 1. WQI BASED ON 6 MAJOR PARAMETERS: BOD, COD, SS, pH, DO, NH<sub>3</sub>-N  
 2. RIVER WATER QUALITY STATUS: C: CLEAN, SP: SLIGHTLY POLLUTED, P: POLLUTED  
 3. RIVER CLASS BASED ON INWQS  
 4. ( ) Overall WQI for 2003  
 5. OVERALL WQI FOR RIVER BASIN IS CALCULATED BY AVERAGING WQI FROM ALL SAMPLING STATIONS IN EACH BASIN THROUGHOUT THE YEAR

Table 4(c) Malaysia: Water Quality Status within Polluted River Basin, 2004

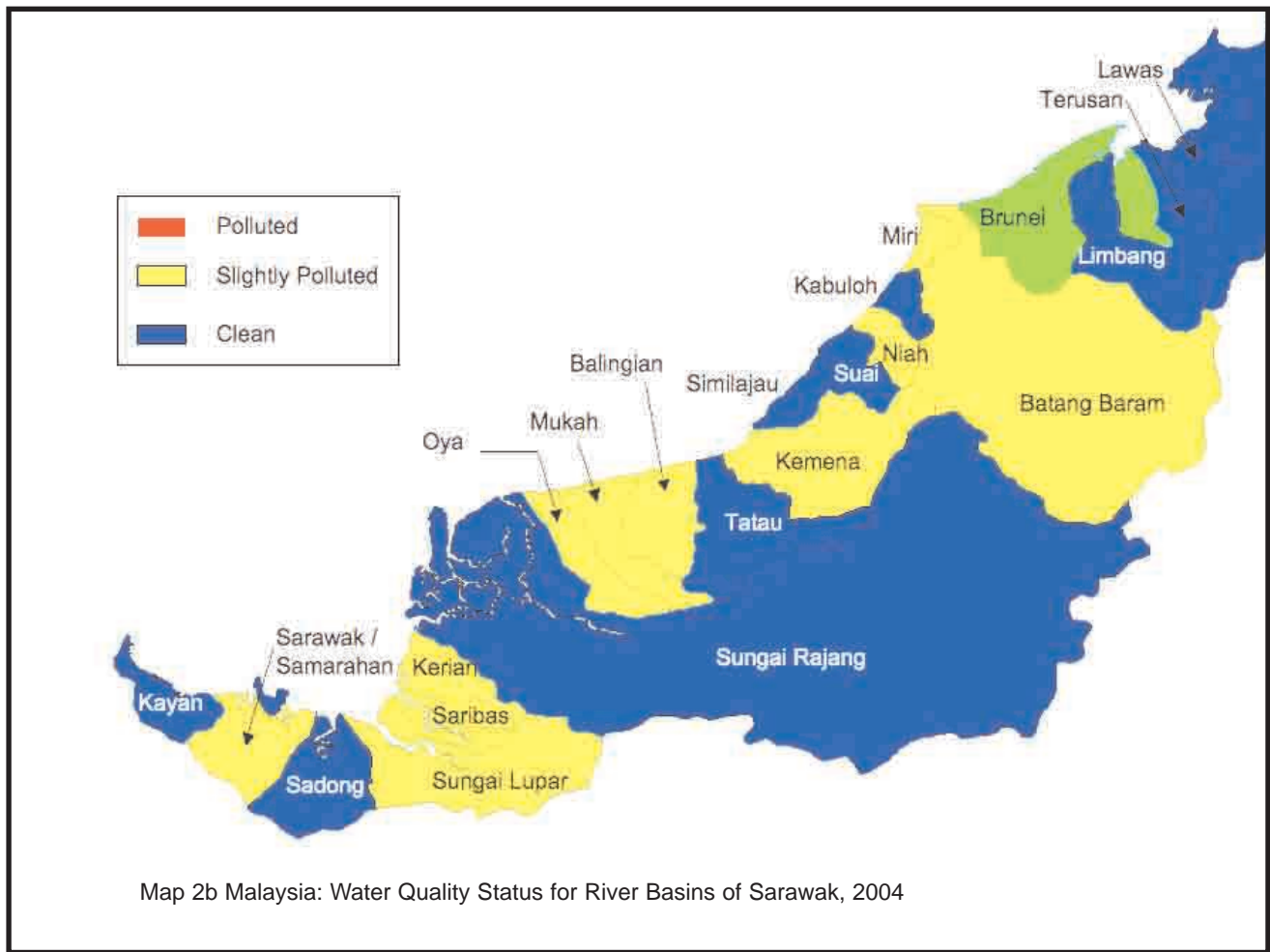
STATE	CODE WQR	RIVER BASIN	NUMBER OF STATIONS	OVERALL WQI	RIVER	NUMBER OF RIVERS	WQI	RIVER STATUS	CLASS
PULAU PINANG	06J	JURU	8	49 (51)	ARA	1	51	P	IV
					JURU	1	47	P	IV
					KILANG UBI	2	46	P	IV
					PASIR	1	44	P	IV
	06PP	PINANG/KLUANG	12	46 (53)	RAMBAI	3	52	P	III
					AIR ITAM	5	47	P	IV
					AIR TERJUN	1	87	C	II
					DONDANG	3	47	P	IV
					JELUTONG	1	29	P	V
	07	JEJAWI	5	58 (60)	KLUANG	1	60	SP	III
					PINANG	1	41	P	IV
					CEMPEDAK	1	41	P	IV
					JAWI	3	67	SP	III
SELANGOR	17	BULOH	5	48 (58)	JUNJONG	1	48	P	IV
					BULOH	5	48	P	IV
	18	KLANG	24	54 (58)	AMPANG	1	54	P	III
					BATU	2	59	P	III
					DAMANSARA	3	53	P	III
					GOMBAK	3	66	SP	III
					JINJANG	1	50	P	IV
					KERAYONG	1	52	P	III
					KEROH	1	51	P	IV
					KLANG	10	52	P	III
KUYOH	1	56	P	III					
PENCALA	1	50	P	IV					
JOHOR	28	SEGGET	5	50 (54)	SEGGET	5	50	P	IV
	28E	KEMPAS	2	45 (44)	KEMPAS	2	45	P	IV
	28F	DANGA	2	55 (52)	DANGA	2	55	P	III
	29B	KAW. PASIR GUDANG (TUKANG BATU)	5	40 (47)	BULUH	1	29	P	V
					LATOH	1	52	P	III
					MASAI	1	57	P	III
					PEREMBI	1	35	P	IV
TUKANG BATU	1	25	P	V					

- NOTE: 1. WQI BASED ON 6 MAJOR PARAMETERS: BOD, COD, SS, pH, DO, NH<sub>3</sub>-N  
 2. RIVER WATER QUALITY STATUS: C: CLEAN, SP: SLIGHTLY POLLUTED, P: POLLUTED  
 3. RIVER CLASS BASED ON INWQS  
 4. ( ) Overall WQI for 2003  
 5. OVERALL WQI FOR RIVER BASIN IS CALCULATED BY AVERAGING WQI FROM ALL SAMPLING STATIONS IN EACH BASIN THROUGHOUT THE YEAR

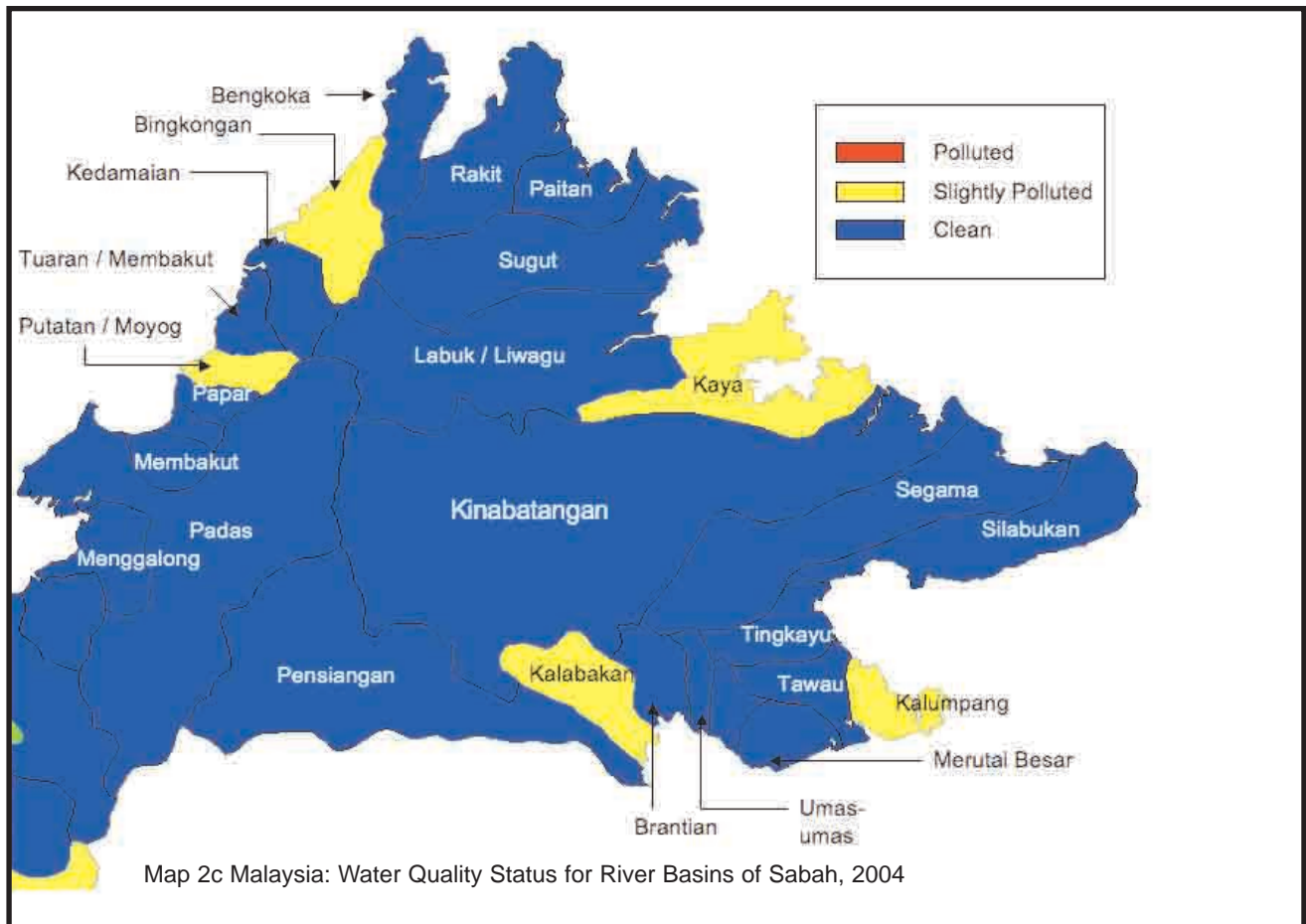




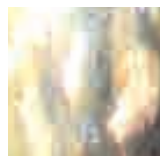
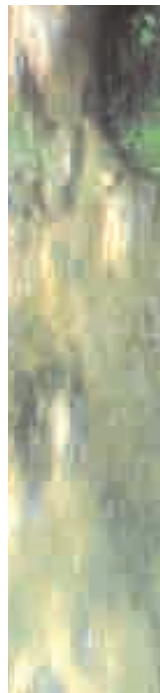
Map 2a Malaysia: Water Quality Status for River Basins of Peninsular, 2004



Map 2b Malaysia: Water Quality Status for River Basins of Sarawak, 2004



Map 2c Malaysia: Water Quality Status for River Basins of Sabah, 2004







# River Water Quality



# GROUNDWATER QUALITY

## GROUNDWATER QUALITY MONITORING

Recognising the potential of groundwater as an important alternative source of water, the Department of Environment initiated the national groundwater monitoring programme in 1997. By 2004, 88 monitoring wells had been established at 48 sites in Peninsular Malaysia, 19 wells in Sarawak and 15 wells in Sabah (Table 5). The sites were selected and categorized according to the surrounding land use such as agricultural, urban/suburban, rural, industrial, solid waste landfills, golf courses, radioactive landfill, animal burial areas, municipal water supply and ex-mining (gold



Table 5 Malaysia: Distribution of Groundwater Monitoring Wells, 2004

Category	Number of Wells
Agricultural Areas	12
Urban/Suburban Areas	12
Industrial Sites	18
Landfills	27
Golf Courses	7
Radioactive Sites	1
Rural Areas	5
Ex-Mining Areas	3
Municipal Water Supply	11
Animal Burial	16
Aquaculture farms	9
Resorts	1
<b>Total</b>	<b>122</b>



Photo 12: Groundwater Monitoring (DOE Photo Library)

## GROUNDWATER QUALITY STATUS

In 2004, 274 water samples were taken from the monitoring wells compared to 226 the previous year. The samples were analysed for volatile organic compounds (VOCs), pesticides, heavy



Photo 13: Sub-Urban Groundwater Monitoring Station (DOE Photo library)

Table 6 Malaysia: National Guidelines for Raw Drinking Water Quality (Benchmark for Groundwater) (Dec 2000)

PARAMETER	SYMBOL	BENCHMARK
SULPHATE	SO <sub>4</sub>	250 mg/l
HARDNESS	CaCO <sub>3</sub>	500 mg/l
NITRATE	NO <sub>3</sub>	10 mg/l
COLIFORM	-	Must not be detected in any 100ml sample
MANGANESE	Mn	0.1 mg/l
CHROMIUM	Cr	0.05 mg/l
ZINC	Zn	3 mg/l
ARSENIC	As	0.01 mg/l
SELENIUM	Se	0.01 mg/l
CHLORIDE	Cl	250 mg/l
PHENOLICS	-	0.002mg/l
TDS	-	1000mg/l
IRON	Fe	0.3mg/l
COPPER	Cu	1mg/l
LEAD ( PLUMBUM )	Pb	0.01mg/l
CADMIUM	Cd	0.003mg/l
MERCURY	Hg	0.001mg/l

Source: Ministry of Health, Malaysia

metals, anions, bacteria, phenolic compounds, radioactivity (Gross Alpha and Beta), total hardness, total dissolved solids (TDS), pH, temperature, conductivity and dissolved oxygen. The groundwater quality status was determined using the National Guidelines for Raw Drinking Water Quality from the Ministry of Health (Revised Dec 2000) (Table 6) as the benchmark.

Iron (Fe) levels exceeding the benchmark were recorded in all samples (Figure 20). Between 23% and 100% of the samples taken from all sites showed high levels of iron. The sampling results also showed that between 10% and 100% of samples taken from all areas recorded

manganese (Mn) levels exceeding the benchmark. Between 3% and 56% of samples from all areas except in radioactive landfill, ex-mining areas, municipal water supply and urban / suburban areas were found to exceed the nitrate benchmark.

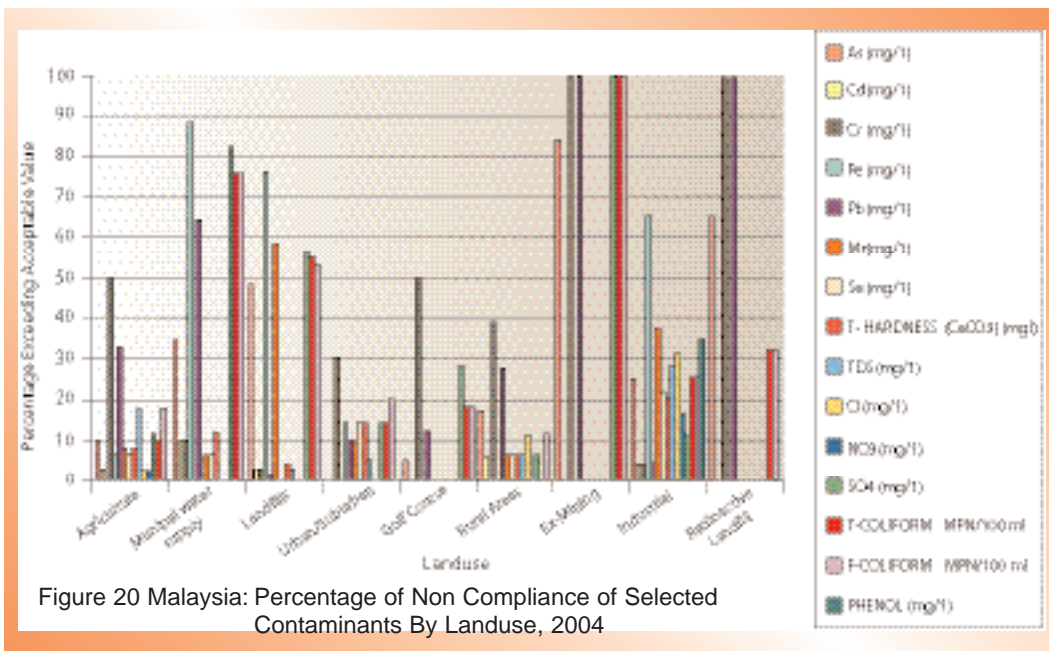
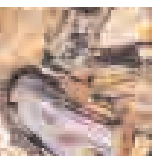
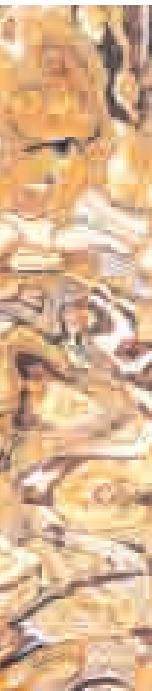


Figure 20 Malaysia: Percentage of Non Compliance of Selected Contaminants By Landuse, 2004







# Groundwater Quality



# 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



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

through field surveys and returned questionnaires. A total of 6,916 sources were identified

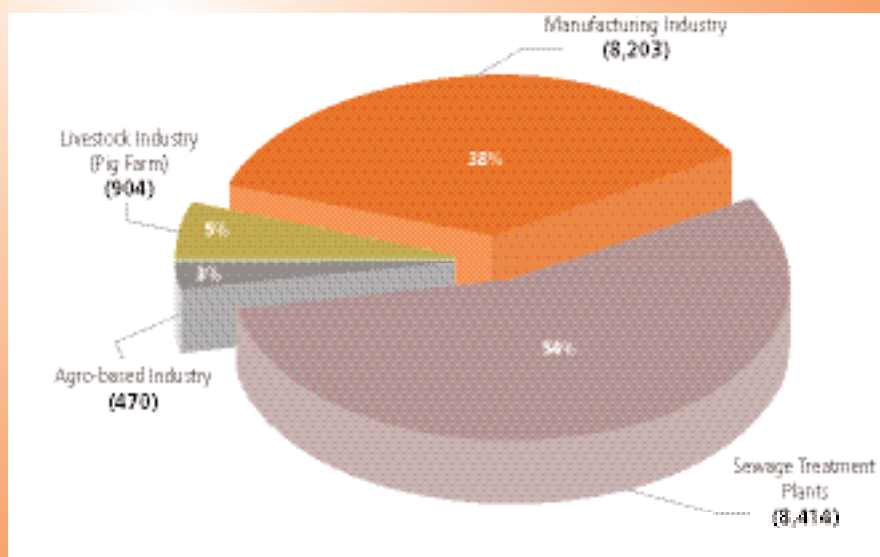


Figure 24 Malaysia: Composition of Water Pollution Sources by Sector, 2004

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)

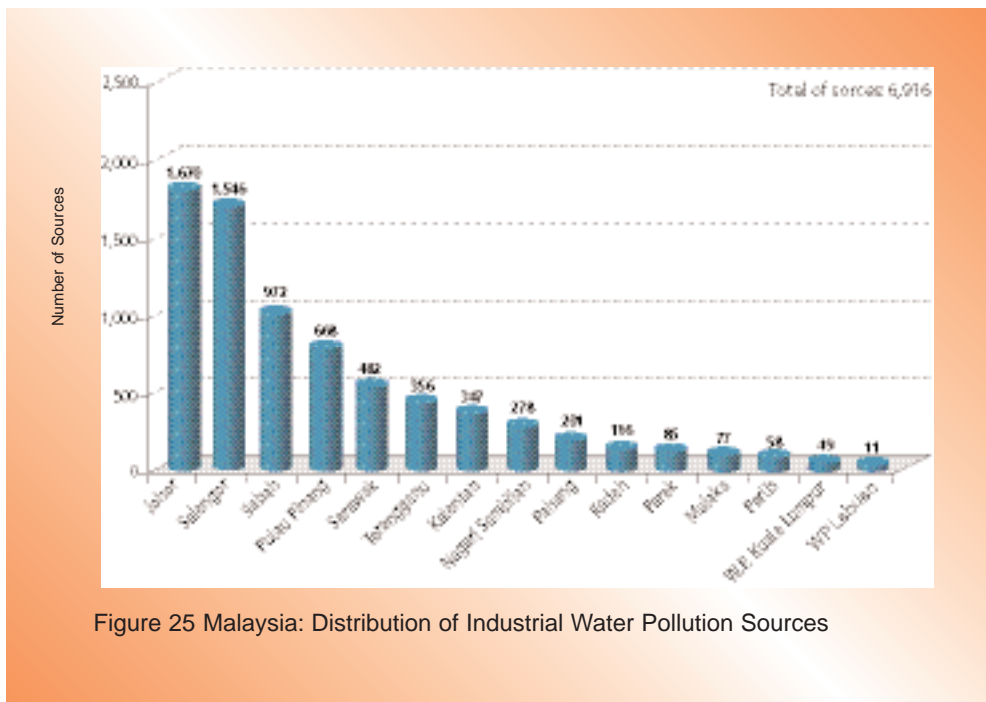


Figure 25 Malaysia: Distribution of Industrial Water Pollution Sources

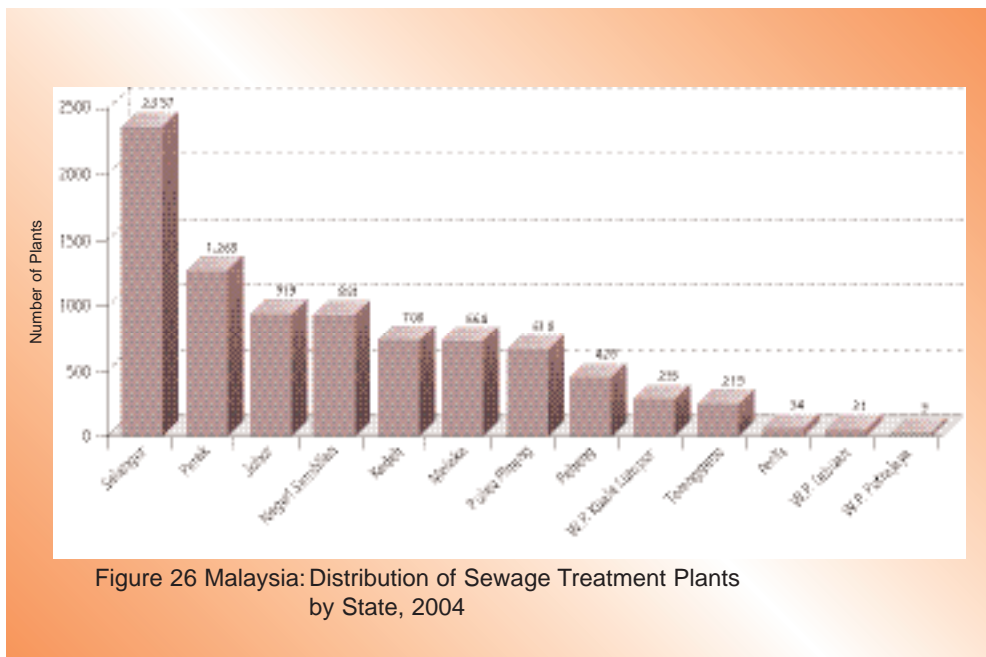


Figure 26 Malaysia: Distribution of Sewage Treatment Plants by State, 2004

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 <sup>3</sup> /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
<b>Total</b>	<b>8,414</b>	<b>16,493,237</b>	<b>3,710,978</b>	<b>927,744.59</b>

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)

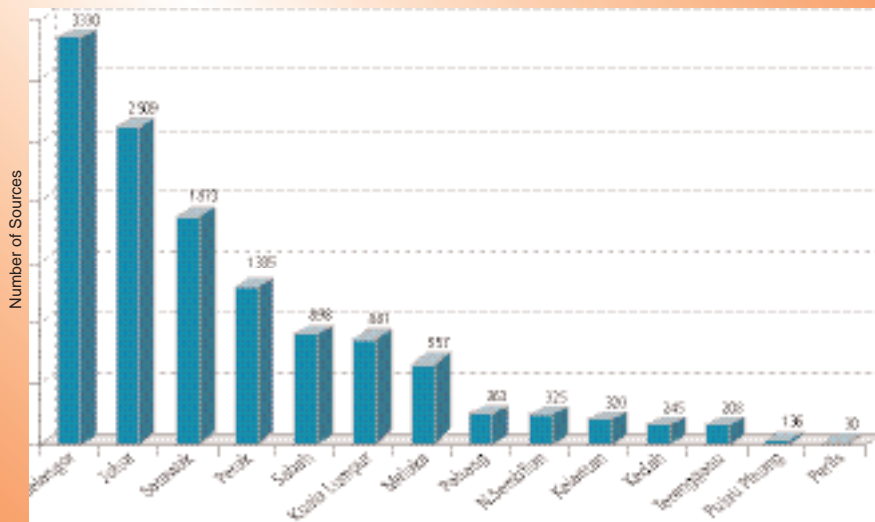


Figure 27 Malaysia: Distribution of Industrial Air Pollution Sources by State, 2004

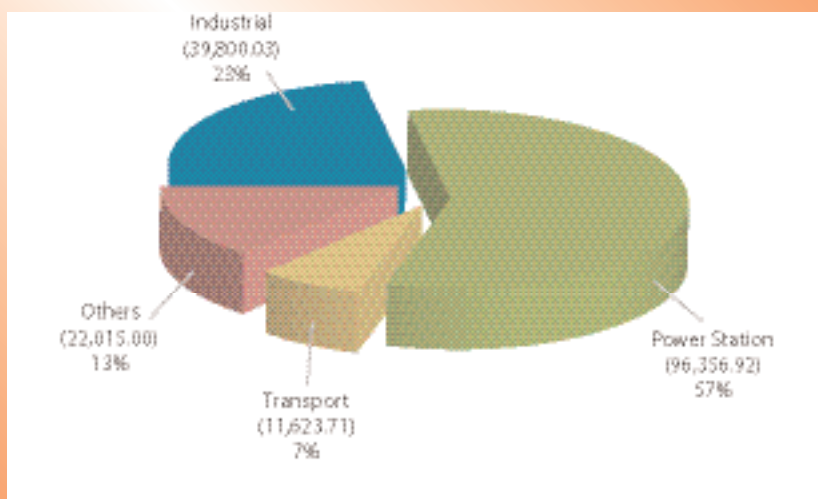


Figure 28 Malaysia: Combined SO<sub>2</sub> Emission by Sources (tonnes), 2004

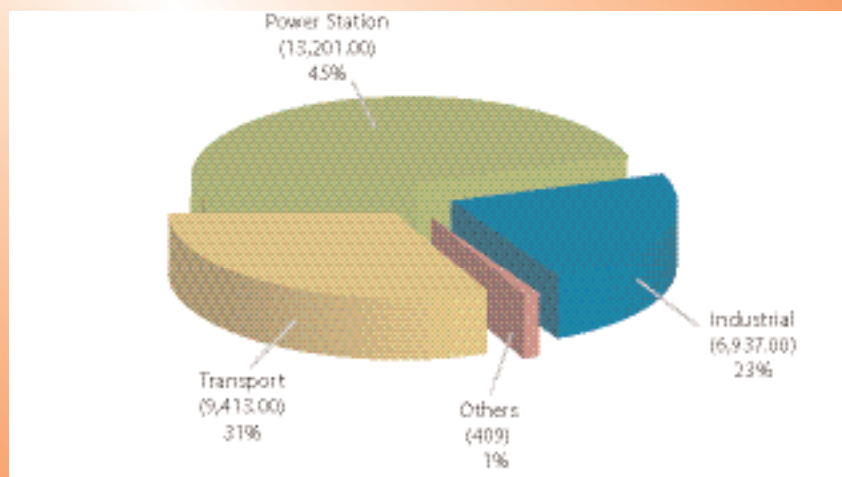


Figure 29 Malaysia: Combined Particulate Matter Emission by Sources (tonnes), 2004

## 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<sub>x</sub>); 169,796 metric tonnes of sulphur dioxide (SO<sub>2</sub>); 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<sub>2</sub> emission load (80%) and particulate matter emission load (68%) (Figure 28, 29), while mobile sources were the main contributors to the NO<sub>x</sub> (59%) and CO (98%) emission load (Figure 30, 31). Compared to 2003, there was appreciable reduction

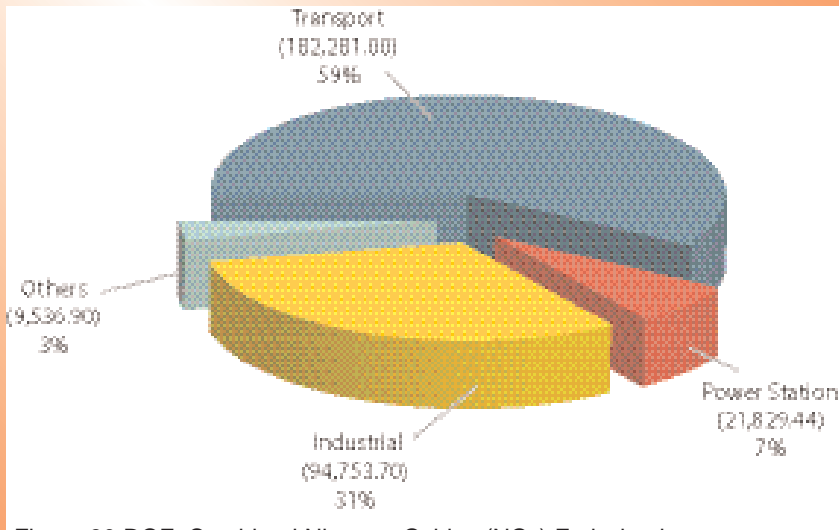


Figure 30 DOE: Combined Nitrogen Oxides (NO<sub>x</sub>) Emission by Sources (tonnes), 2004

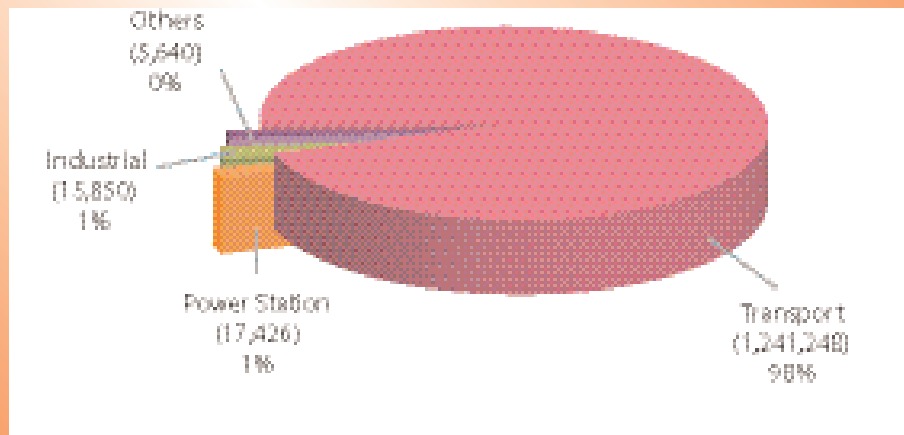


Figure 31 DOE: Combined Carbon Monoxide (CO) Emission by Sources (tonnes), 2004

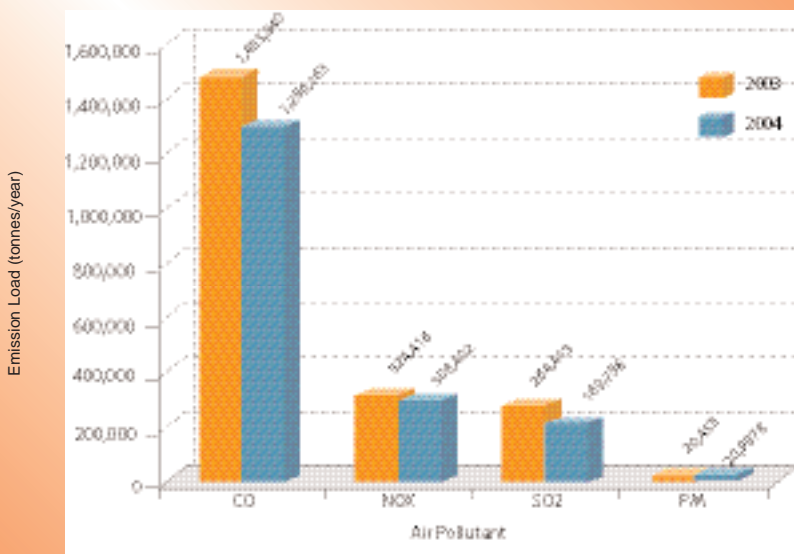


Figure 32 DOE: Air Pollutant Emission Load from Stationary Sources, 2003- 2004

## 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

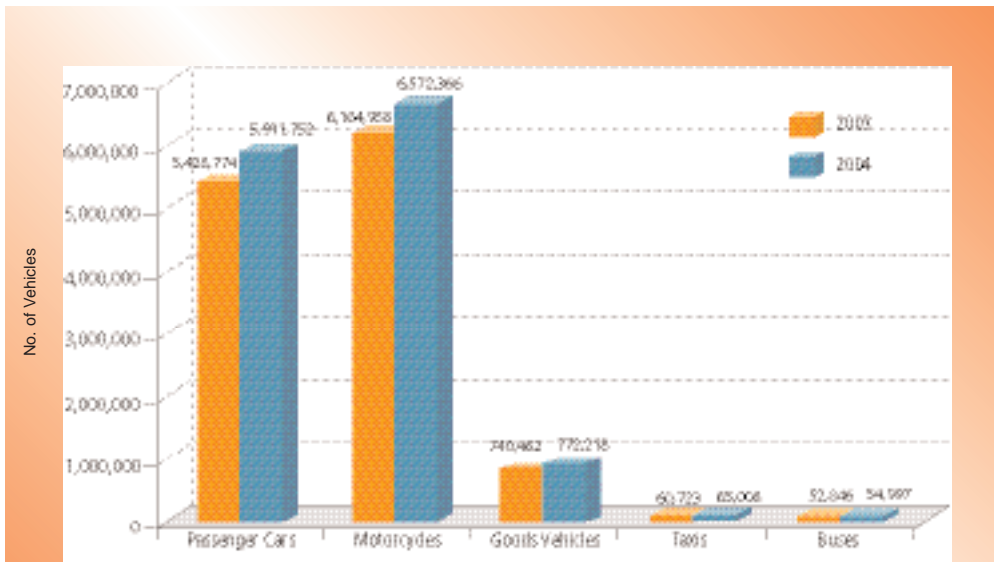


Figure 33 Malaysia: Number of Registered Vehicles, 2003-2004  
\*Source: Road Transport Department, Malaysia, 2004

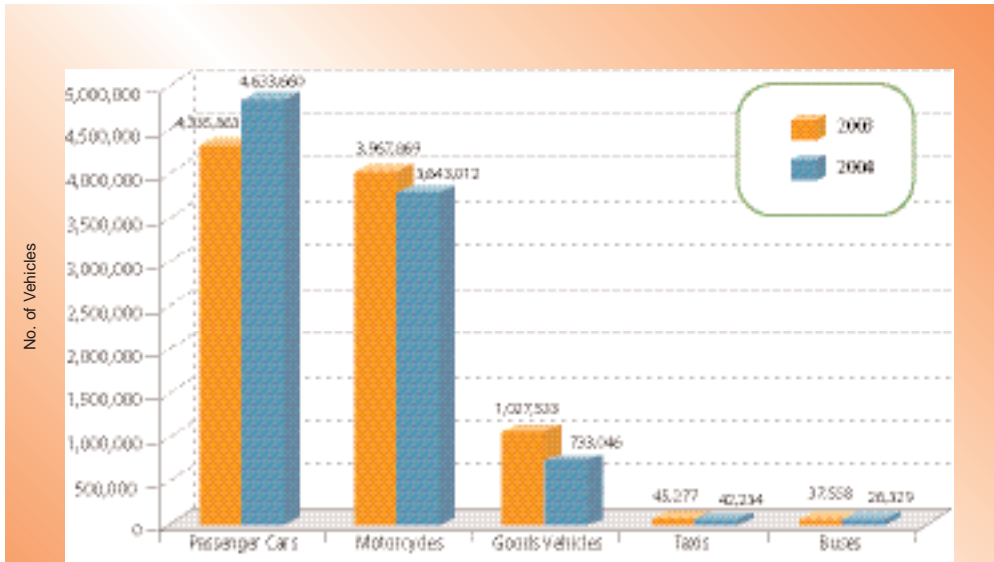


Figure 34 Malaysia: Number of In-Use Vehicles, 2003-2004  
\*Source: Road Transport Department, Malaysia, 2004



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<sub>10</sub>), nitrogen dioxide (NO<sub>2</sub>) and sulphur dioxide (SO<sub>2</sub>) 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<sub>10</sub>, SO<sub>2</sub> and NO<sub>2</sub> in 2004. Emission load of PM<sub>10</sub> was 4,174 metric tonnes in 2004 as compared to 7,266 metric tonnes in 2003 (42.6% decrease), SO<sub>2</sub> was 11,624 metric tonnes in 2004 as compared to 16,984 metric tonnes in 2003 (31.6% decrease) and NO<sub>2</sub> 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<sub>10</sub>, NO<sub>2</sub>, SO<sub>2</sub> and CO emission loads, while motorcycles contributed the highest emission load

for HC.

Figure 36 indicates that 62.4% of PM<sub>10</sub> 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<sub>2</sub> 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<sub>2</sub>, 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-

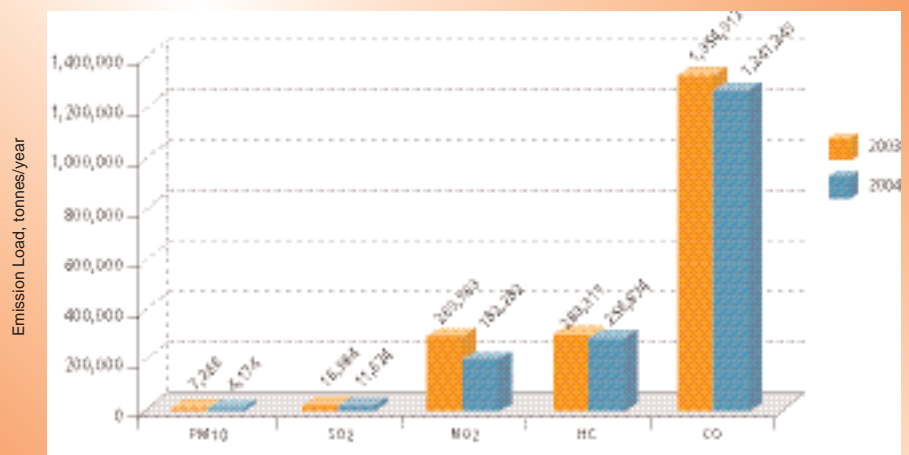


Figure 35 Malaysia: Air Pollutant Emission Load from Mobile Sources, 2003-2004

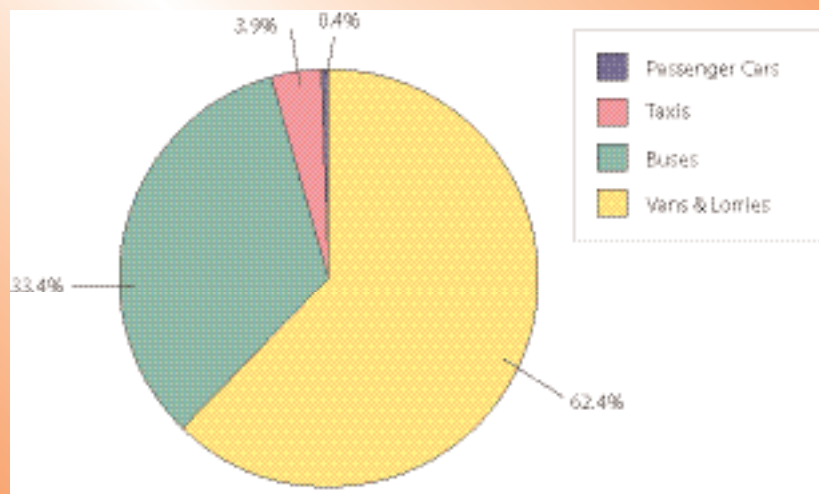


Figure 36 Malaysia: Distribution of PM<sub>10</sub> Emission Load from Mobile Sources, 2004

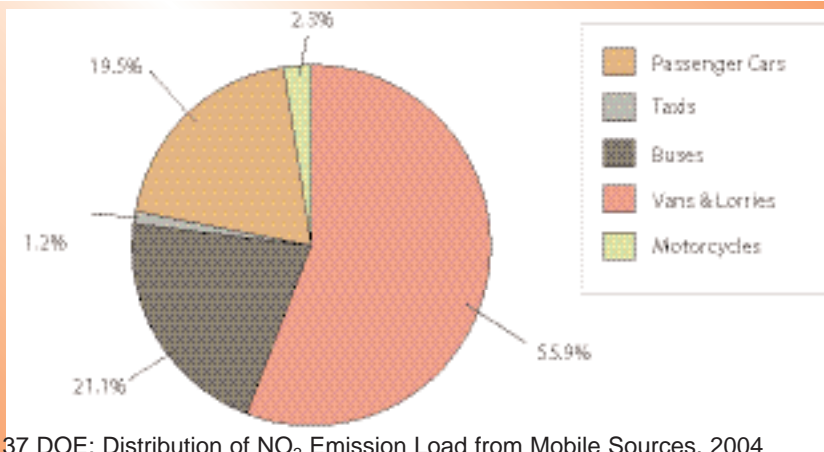


Figure 37 DOE: Distribution of NO<sub>2</sub> Emission Load from Mobile Sources, 2004

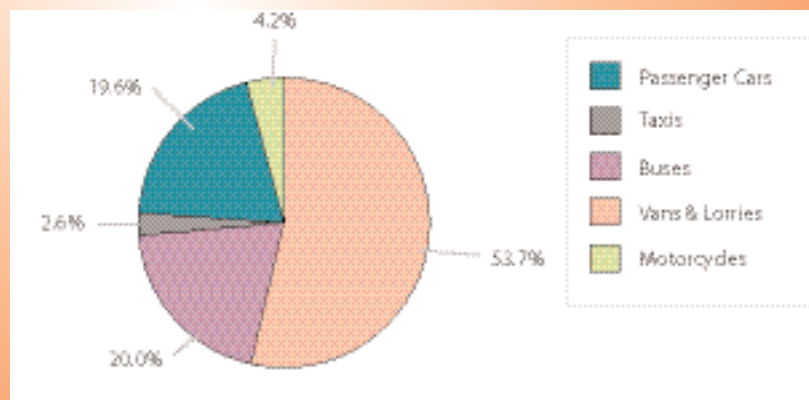


Figure 38 DOE: Distribution of SO<sub>2</sub> Emission Load from Mobile Sources, 2004

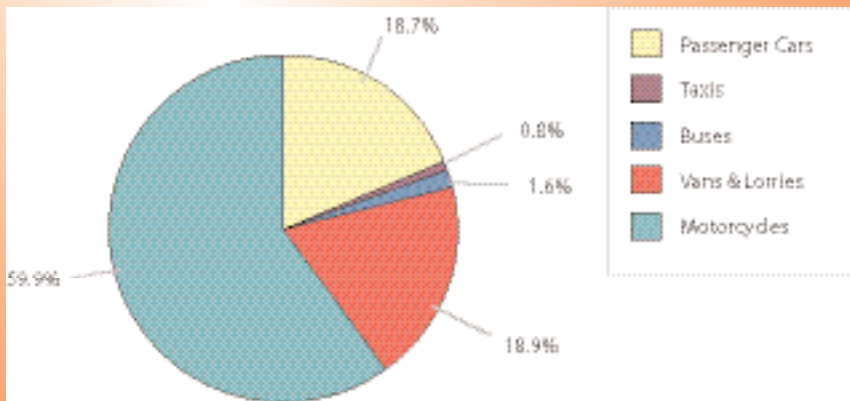


Figure 39 DOE: Distribution of HC Emission Load from Mobile Sources, 2004

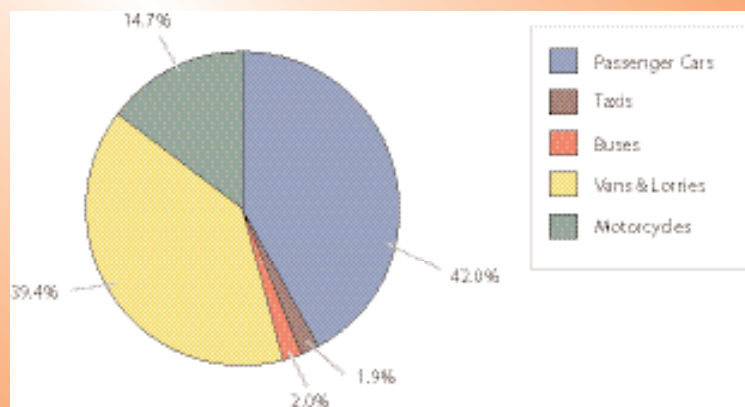


Figure 40 DOE: Distribution of CO Emission Load from Mobile Sources, 2004

## 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.

(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).

Of the total wastes produced, 88,268.0 tonnes

Six landfarms and 35 on-site waste incinera-

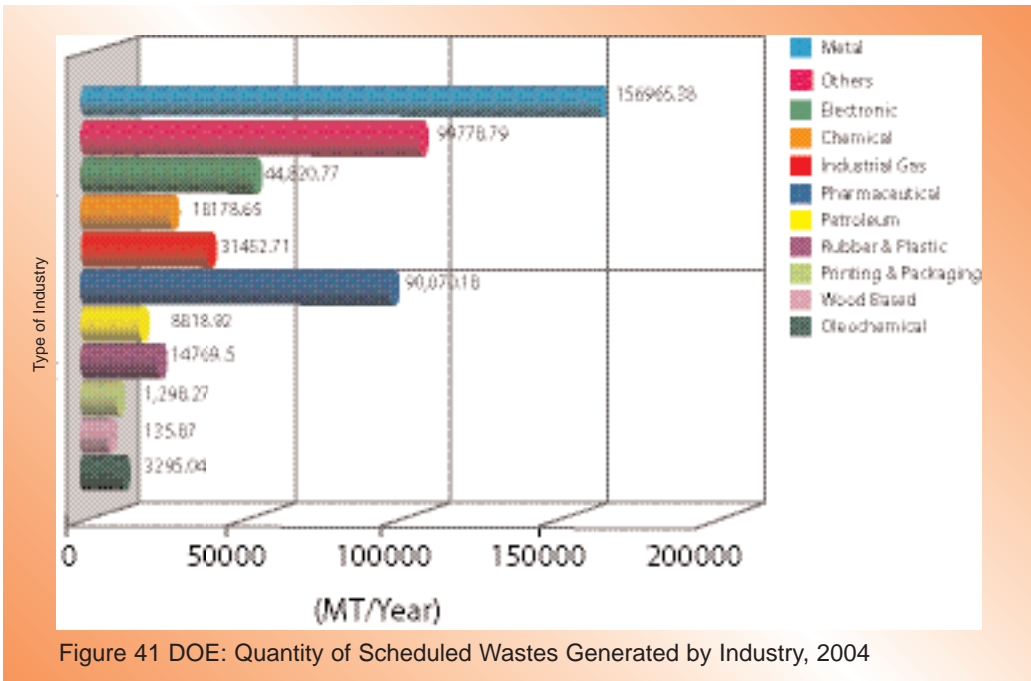


Figure 41 DOE: Quantity of Scheduled Wastes Generated by Industry, 2004

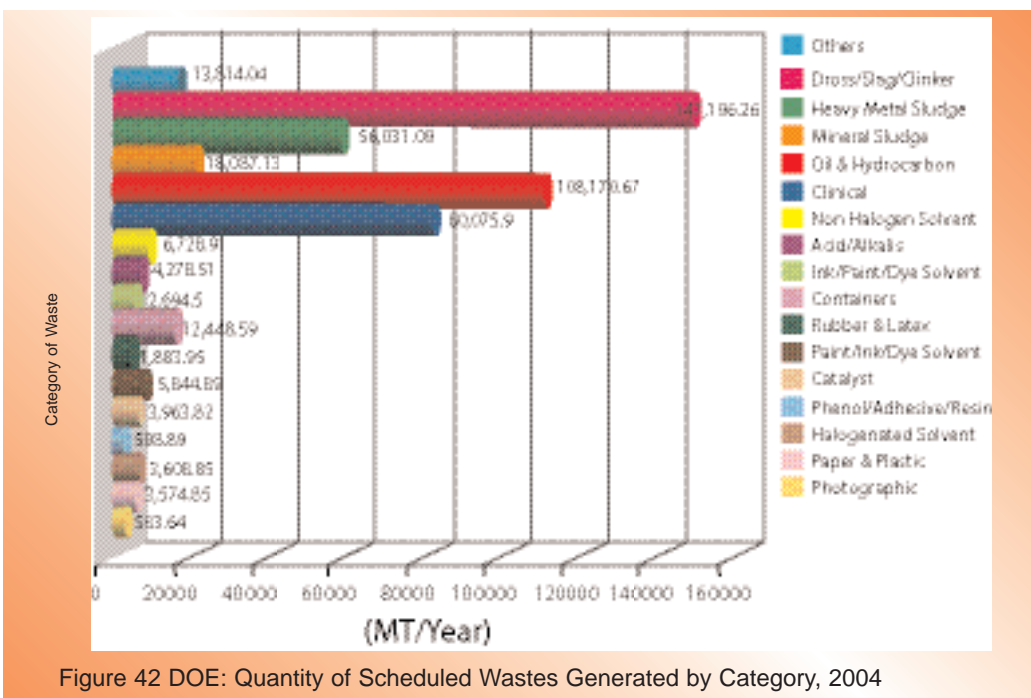


Figure 42 DOE: Quantity of Scheduled Wastes Generated by Category, 2004

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
<b>Total</b>	<b>469,584.07</b>	<b>100.00</b>

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
<b>Total</b>	<b>469,584.07</b>	<b>100.00</b>

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
<b>TOTAL</b>	<b>469,584.07</b>	<b>100.00</b>



**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 %).

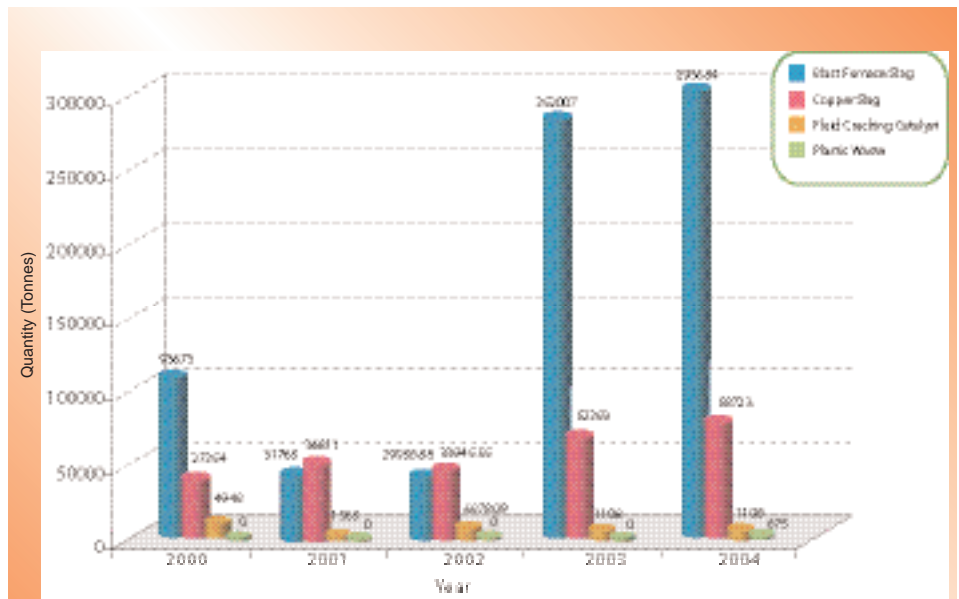


Figure 43 DOE: Quantity and Type of Scheduled Wastes Imported (Tonnes), 2000 - 2004

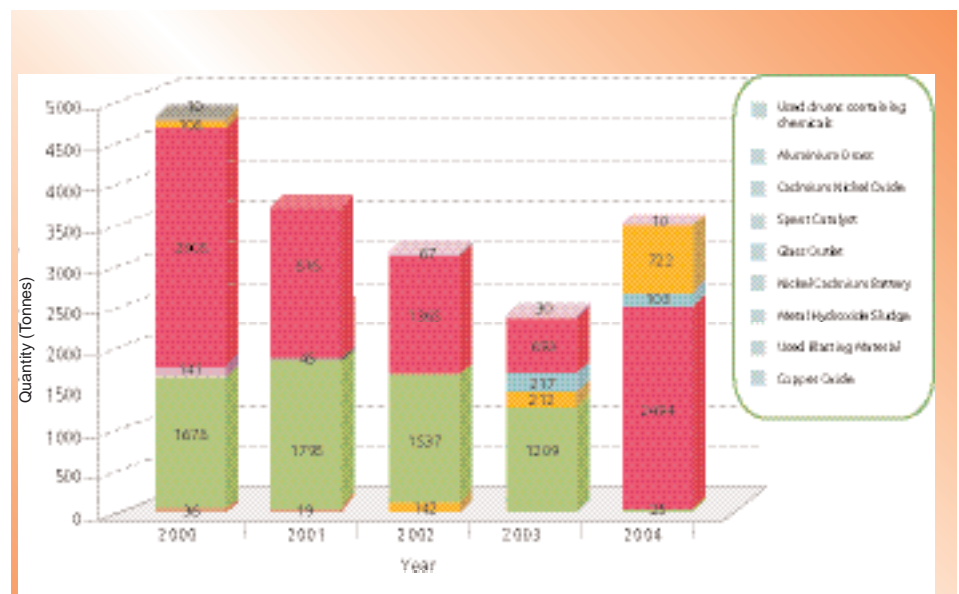


Figure 44 DOE: Quantity and Type of Scheduled Wastes Exported (Tonnes), 2000 - 2004

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
<b>Total</b>	<b>4,878</b>	<b>2,675</b>	<b>3,110</b>	<b>2,361</b>	<b>3,354</b>



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
Sr	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 <sub>2</sub>	mg/l			- (0.02)	-	
CN	mg/l		0.02	0.06 (0.02)	-	
F	mg/l		1.5	10	1	
N O <sub>2</sub>	mg/l		0.4	0.4 (0.03)	-	
N O <sub>3</sub>	mg/l		7	-	5	
P	mg/l		0.2	0.1	-	
Silica	mg/l		50	-	-	
SO <sub>4</sub>	mg/l		250	-	-	
S	mg/l		0.05	- (0.001)	-	
C O <sub>2</sub>	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<sub>3</sub>

# = 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) <sup>a</sup>	5000 (20000) <sup>a</sup>	-
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 II - sensitive aquatic species
- CLASS IIB : Recreational use with body contact
- CLASS III : Water Supply III - extensive treatment required  
Fishery III - 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 (NH <sub>3</sub> -N)	92 - 100	71 - 91	0 - 70
Suspended Solids (SS)	76 - 100	70 - 75	0 - 69



# POLLUTION SOURCES INVENTORY

