

MALAYSIA

Environmental Quality Report

2000



Department of Environment
Ministry of Science,
Technology and the Environment
Malaysia



Department of Environment, Malaysia

DEPARTMENT OF ENVIRONMENT, MALAYSIA

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CONTENTS

FOREWORD

3

AIR QUALITY

Air Quality Monitoring	7
Air Quality Status	7
Air Quality Trends	13
Particulate Matter (PM 10) levels	15
Sulphur Dioxide (SO ₂) levels	18
Nitrogen Dioxide (NO ₂) levels	18
Ground Ozone (O ₃) levels	18
Carbon Monoxide (CO) levels	20
Lead (Pb) levels	20

NOISE MONITORING

Noise Monitoring	25
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RIVER WATER QUALITY

River Water Quality Status	31
----------------------------	----

GROUND WATER QUALITY

Ground Water Quality Monitoring	49
Ground Water Quality Status	49

MARINE ENVIRONMENTAL QUALITY

Marine Water Quality Status	61
Island Marine Water Quality Status	65
Beach Oil Pollution (Tarballs)	67

POLLUTION SOURCES INVENTORY

Inventory of Water Pollution Sources	73
BOD Pollution Load	75
Air Pollution Sources	76
Air Pollution Load	76
Scheduled Wastes Inventory	78
Basel Convention on Transboundary Movement of Hazardous Wastes and Their Disposal	79

ANNEX

84

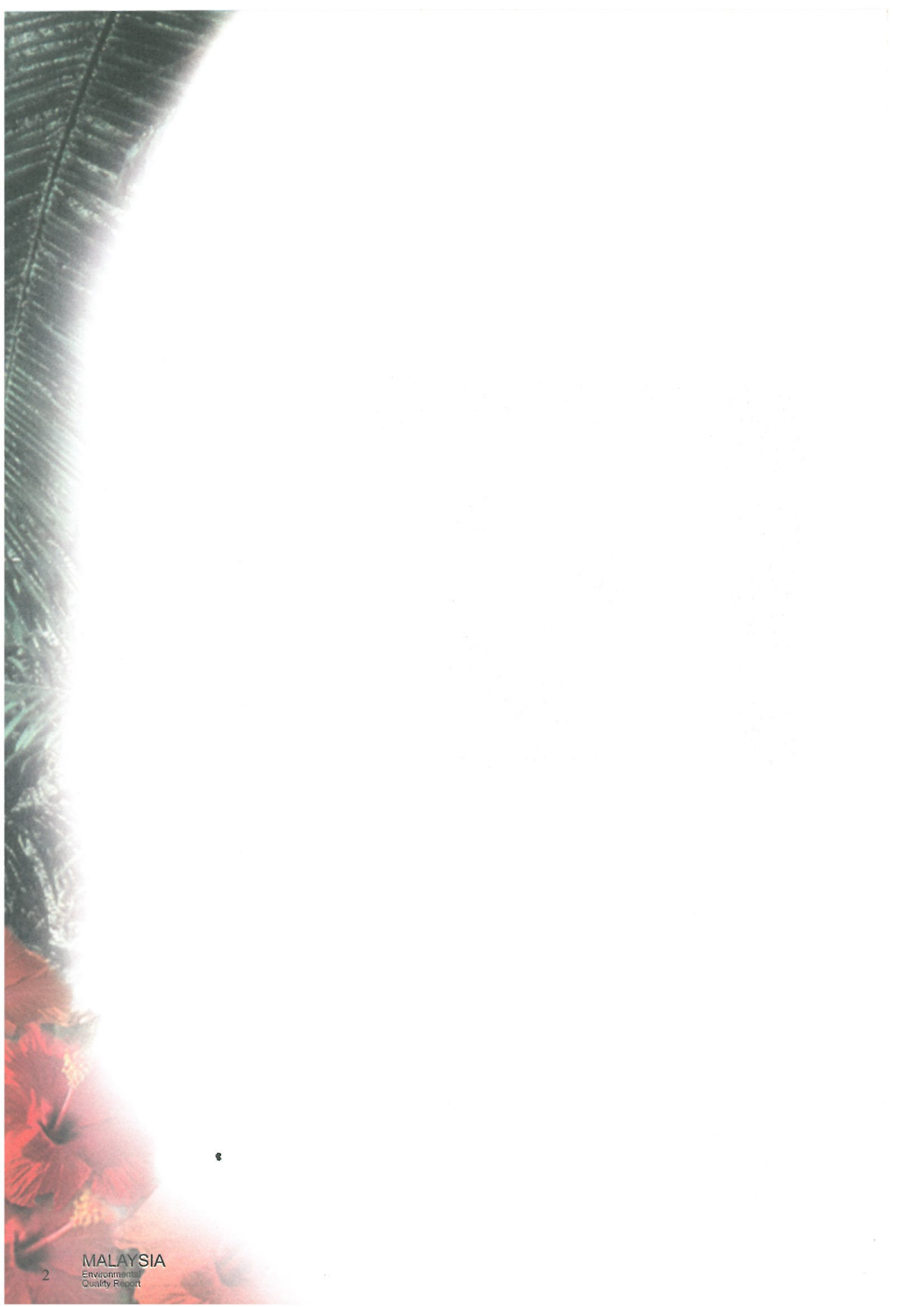


MALAYSIA

Environmental
Quality Report



FOREWORD



FOREWORD

As required under Section 3(1)(i) of Environmental Quality Act 1974, I hereby submit the 2000 Environmental Quality Report.

As the year 2000 heralds the beginning of a new era of unforeseen challenges and opportunities, it is opportune to take stock before embarking on a new journey. This is particularly essential in the environmental arena, to chart a course of action for environmental sustainability in the years ahead.

The Department of Environmental celebrated its Silver Jubilee on 15 September 2000, an occasion to mark 25 years of joy and disappointments to bring DOE to where it is today; a time to reflect on its achievements, actions and omissions. Much more need to be done to deal with issues of water pollution, air pollution, hazardous and toxic wastes, megacity evolution, environmental apathy and so on.

Our urgent task for the immediate future is to undertake a concerted programme to clean up rivers which have taken the brunt of developmental pressures over the years. Groundwater quality will similarly receive appropriate attention as we brace ourselves for the challenge of ensuring sufficient safe and clean potable water. Other environmental issues will likewise be attended to, albeit on a different scale of urgency.

The time has come to make changes. Past approaches that have proven ineffective need to be set aside and new solutions must be put in place. This change may not be easy or straightforward, but in the final analysis, it is the ability to environmentally sustain human progress and development that matters most.

“Jangan Mencemar Sungai, Ia Nadi Kehidupan Kita”

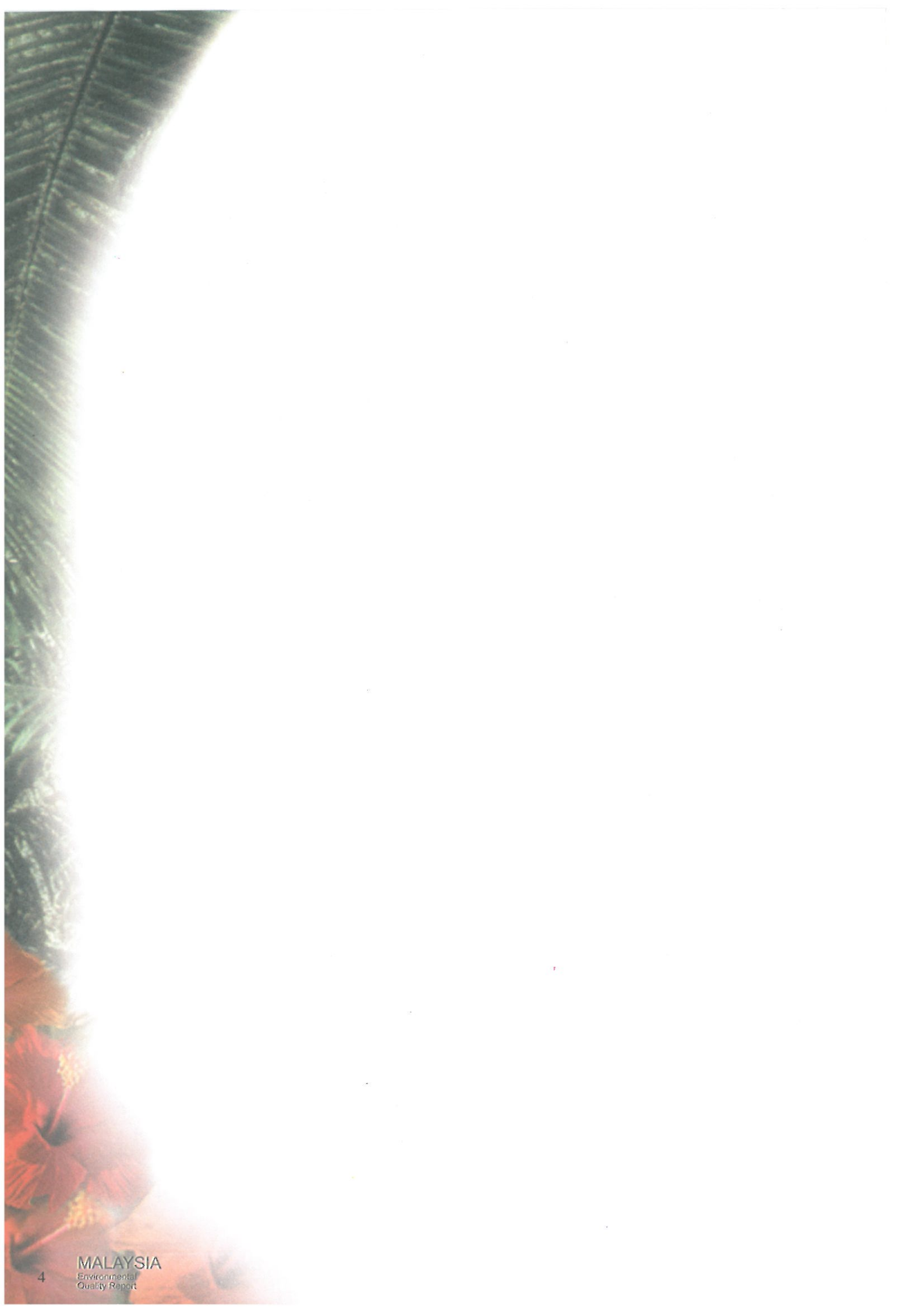
With Best Wishes



HAJAH ROSNANI IBARAHIM
Director-General of Environmental Quality
Malaysia

14 September 2001



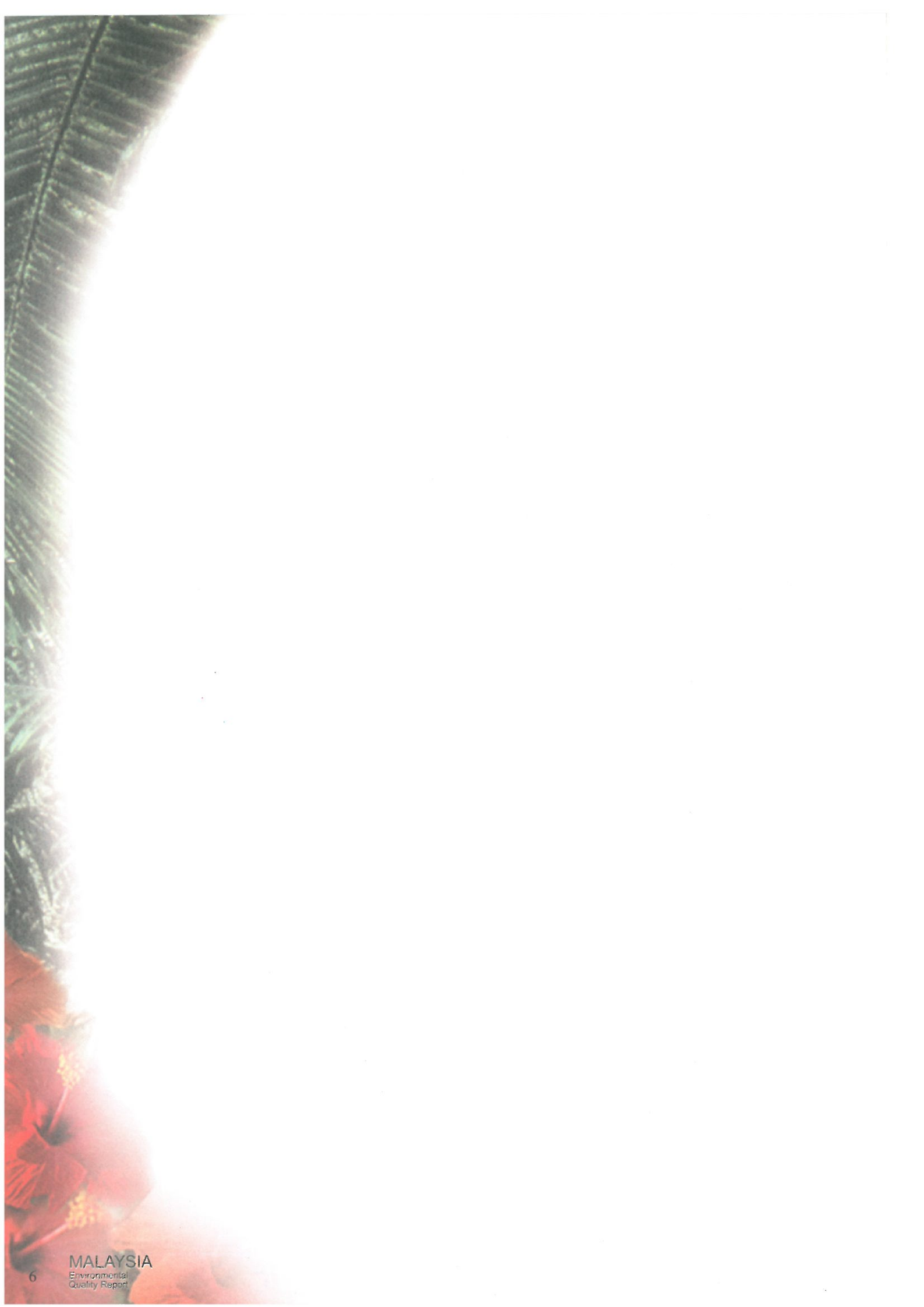


MALAYSIA

Environmental
Quality Report



AIR QUALITY



AIR QUALITY MONITORING

Introduction

Ambient air quality is routinely monitored by the Department of Environment to detect air quality changes that could be harmful to human health and the environment. This remains one of the important tasks of the Department i.e to protect the well being of the Malaysian population and the environment from pollution.

The air quality is monitored based on actual measurements of pollutant concentrations in the ambient air at selected monitoring sites throughout the country. By year end 2000, 6 new Continuous Air Quality Monitoring



Photo 1:
Continuous Air Quality
Monitoring Station.
(DOE Photo Library)

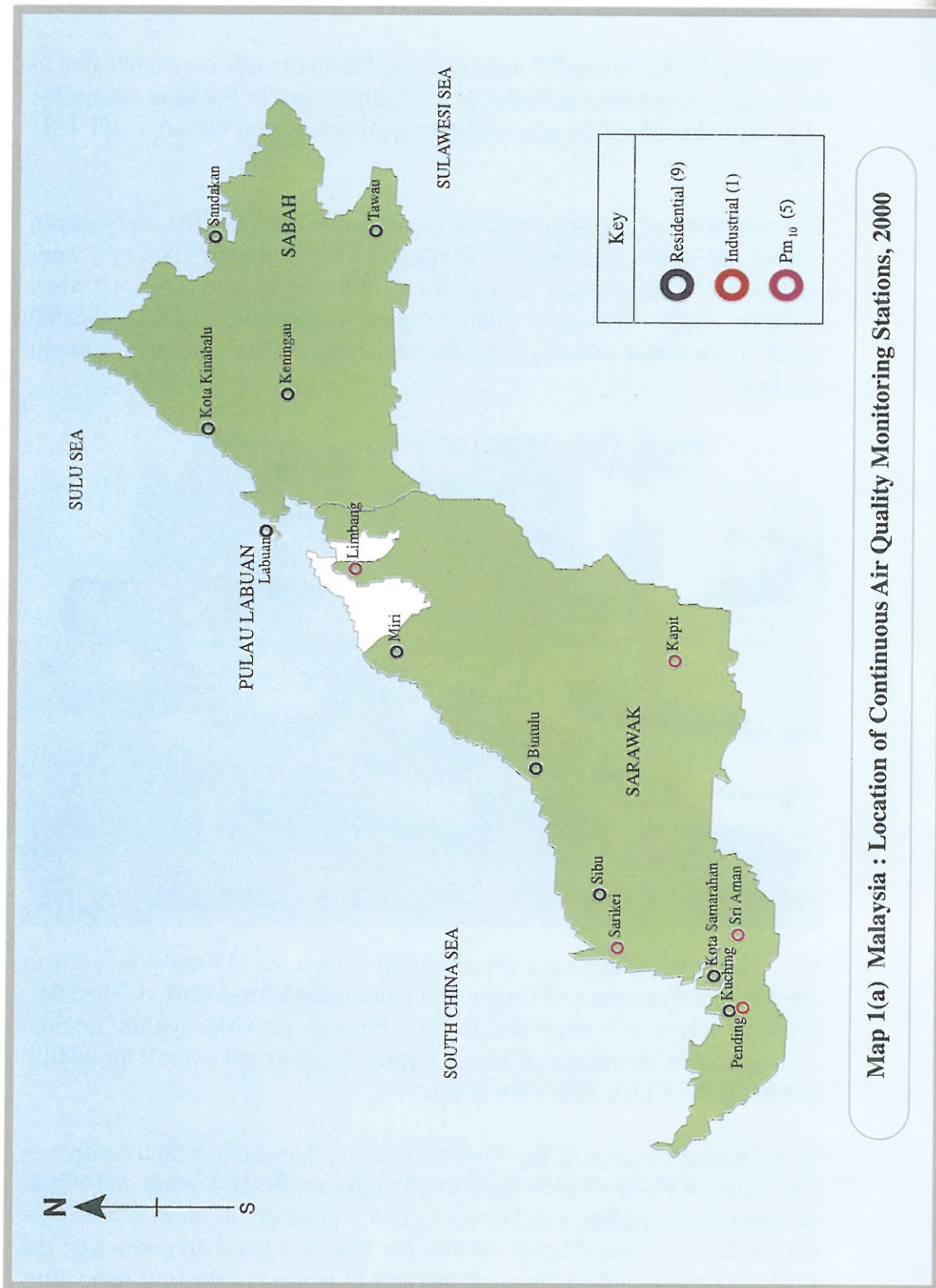
(CAQM) Stations had been established in addition to the existing 44 stations. With the installation of these new stations, the National Air Quality Monitoring Network consisting of 50 Continuous Air Quality Monitoring Stations is fully implemented. These stations are strategically located throughout the country (**Map 1** and **Map 1(a)**). At these stations, the presence of pollutants in the air emitted from various sources such as motor vehicles, industries, open burning activities, etc. are continuously monitored.

The National Air Quality Monitoring network is also complemented by Manual Air Quality Monitoring Stations located at 33 different sites using High Volume Samplers.

Air Quality Status in 2000

The air quality status for Malaysia is reported in terms of Air Pollutant Index (API). The overall air quality status for Malaysia throughout 2000 was between good (API 0-50) to moderate (API 51-100) most of the time,





except for a few unhealthy days experienced during the drier months of May and July.

The Klang Valley, being the most developed and densely populated area in the country, experienced moderate air quality most of the time except for 11 to 32 unhealthy days where the air quality hovered between API 101-200.

The unhealthy air quality conditions experienced in Shah Alam (14 days), Kajang (32 days), Gombak (22 days) and Kuala Lumpur (11 days) were mainly due to the presence of high levels of ozone. Ozone is formed when nitrogen oxides (NO_x) and volatile organic compounds (VOCs), emitted mainly from motor vehicles and industries, react in the presence of sunlight and heat.



Photo 2:
Mobile Sources of
Urban Air Pollution
(DOE Photo Library)

However in the Klang area, the unhealthy air quality (17 days) was due to the combined presence of Ozone and Particulate Matter (PM₁₀). The PM₁₀ levels in Klang was attributed to open burning activities within the area particularly in the month of May. **Figure 1** shows the overall air quality status for the Klang Valley for 2000.

In the northern region of the west coast of the Peninsula, which comprises the States of Perlis, Kedah including Langkawi, Pulau Pinang and Perak, the overall air quality was between good and moderate most of the time except the Prai area. The air quality for Prai was good 16 percent of the time, 69 percent of the time moderate and 15 percent of the time unhealthy. The main pollutant of concern was sulphur dioxide (SO₂) emitted by industrial activities in the Prai industrial area. **Figure 2** describes the overall air quality status for the west coast of the Peninsula.

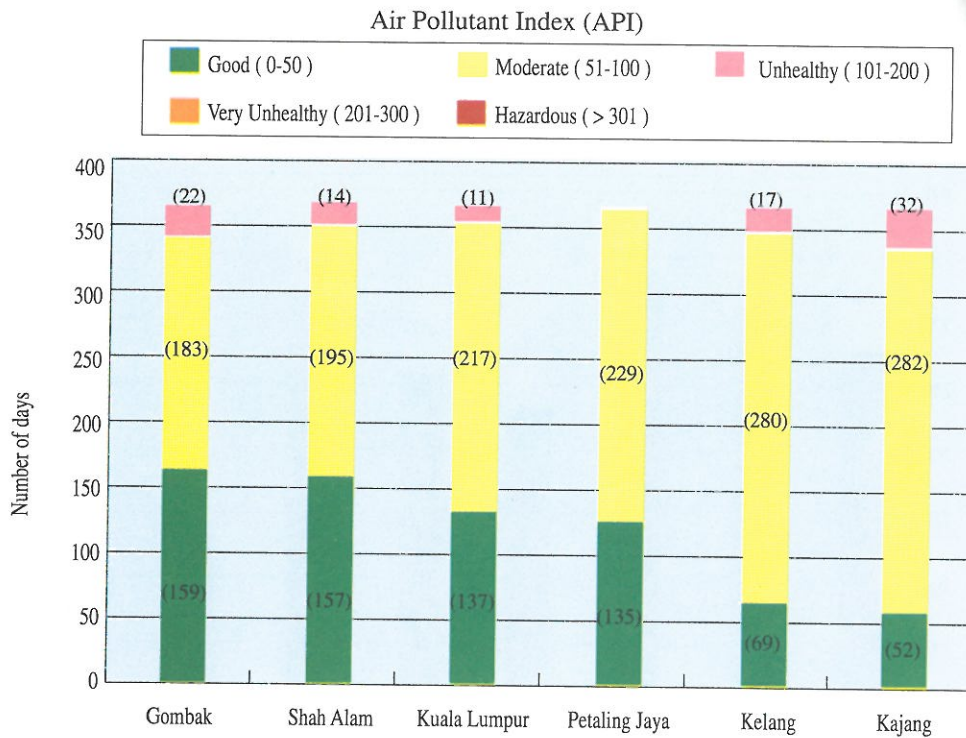


Figure 1 Department of Environment : Air Quality Status in the Klang Valley, 2000
() number of days

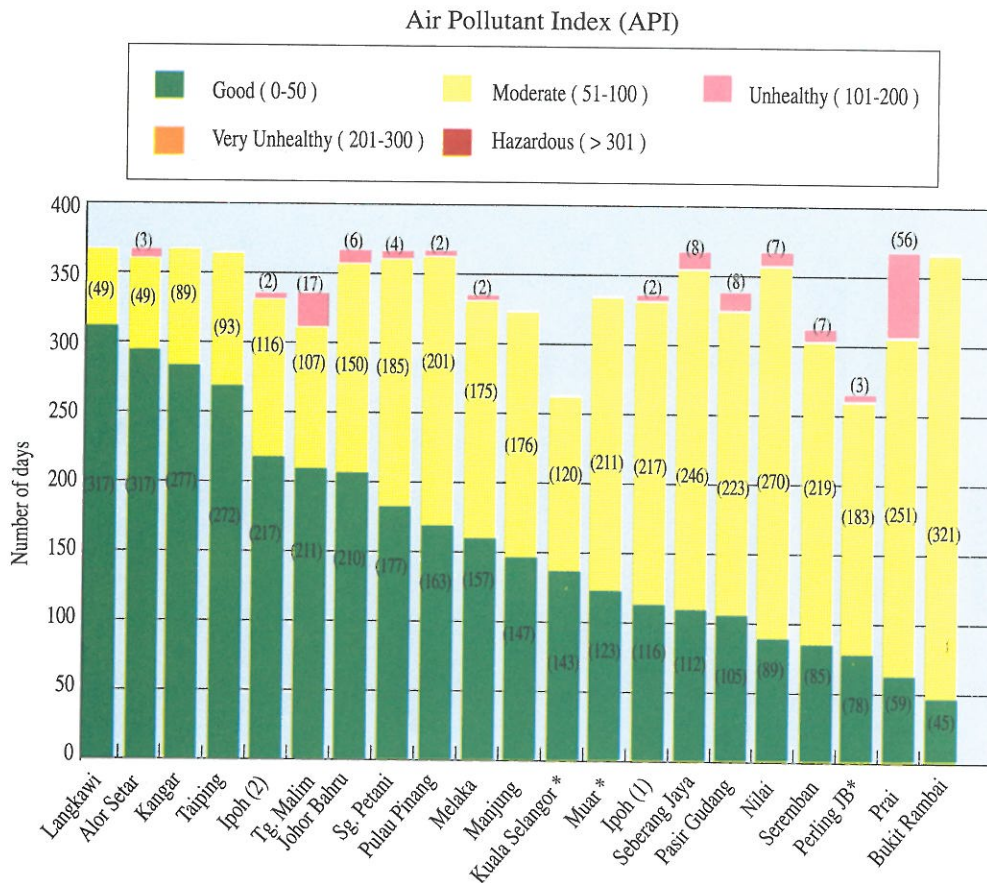


Figure 2 Department of Environment : Air Quality Status of West Coast of Peninsula, 2000
* new installations () number of days

Air Pollutant Index (API)

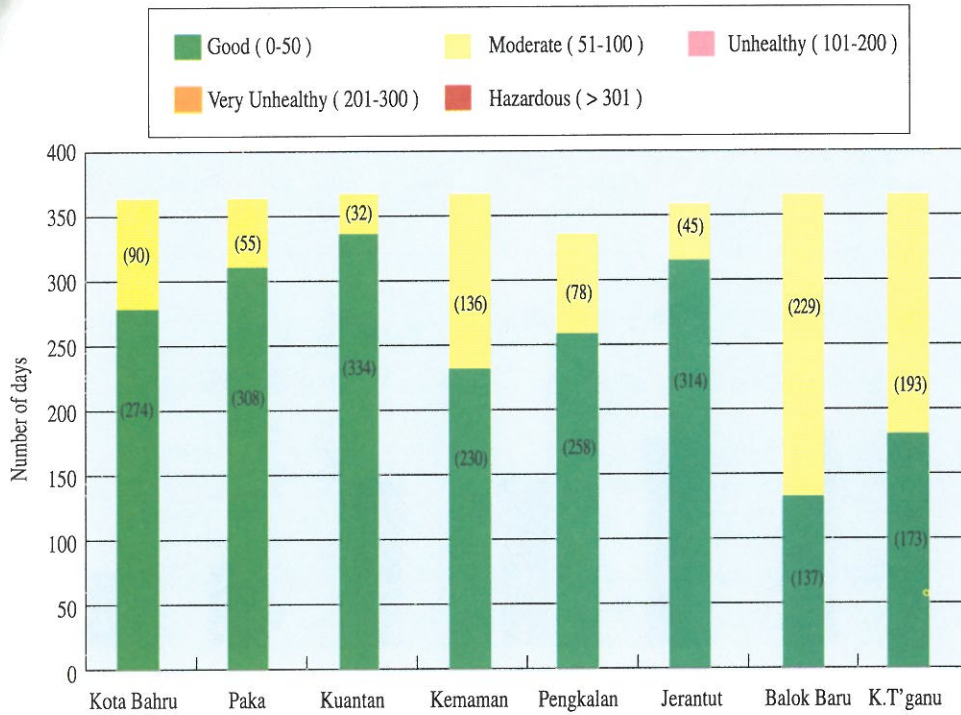


Figure 3 Department of Environment : Air Quality Status of East Coast of Peninsula , 2000
() number of days

Air Pollutant Index (API)

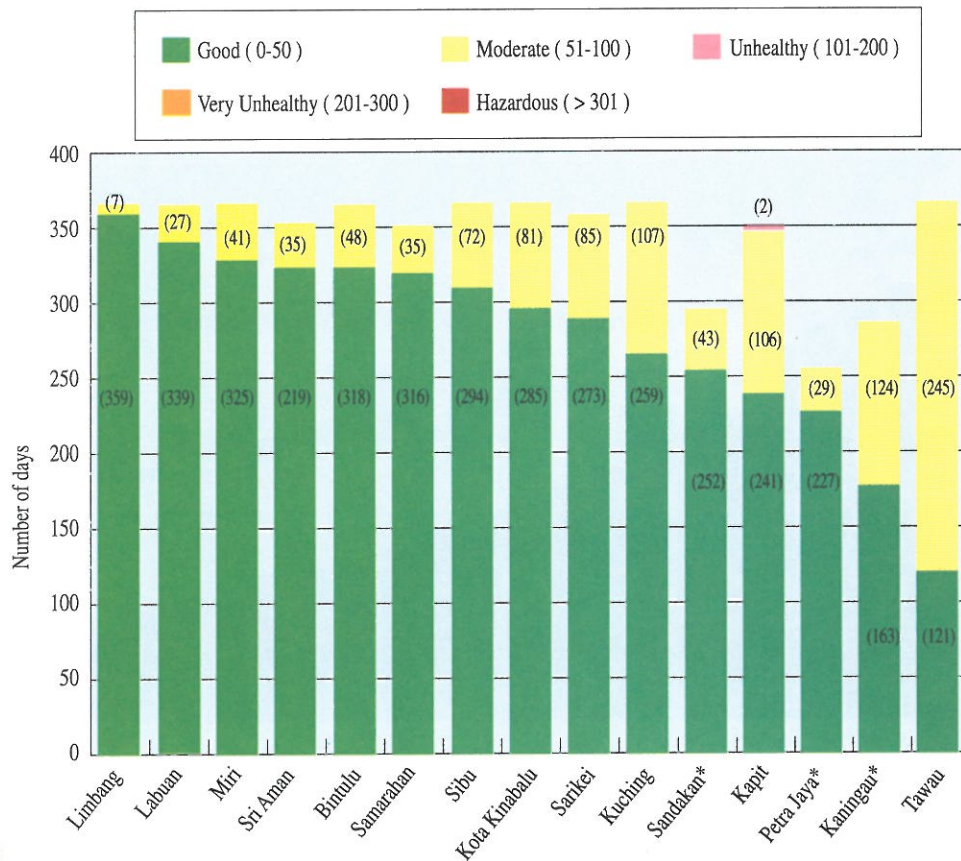


Figure 4 Department of Environment : Air Quality Status in Sabah and Sarawak, 2000
* new installations () number of days

Similarly the air quality in the southern region of the west coast which covers Negeri Sembilan, Melaka and Johor, was between good to moderate most of the time, except for eight days of unhealthy air quality at Pasir Gudang, Johor. The stations at Seremban and Nilai (south of the Klang Valley) each recorded 7 unhealthy days in May due to high PM10. The poor air quality was due to open burning at a municipal dumping site nearby Seremban.

However in the east coast of the Peninsula, the air quality was good almost 80% of the time, such as in Kuantan, Jerantut and Paka. The air quality in Kota Bharu, Pengkalan Chepa and Kemaman was good more than 70% of the time, while in Balok Baru and Kuala Terengganu, the air quality was moderate 58% of the time (**Figure 3**).



*Photo 3:
Open Burning at a
construction site
(DOE Photo Library)*

In Sabah and Sarawak, the air quality was good almost 70% of the time except for two stations at Keningau and Tawau in Sabah where the air quality was moderate more than 50% of the time (**Figure 4**)

Air Quality Trends

Data on air pollutant concentrations from all monitoring stations were collected and analysed. Five principal pollutants, namely Carbon Monoxide (CO), Nitrogen Dioxide (NO₂), Ozone (O₃), Sulphur Dioxide (SO₂) and Particulate Matter (PM10) were monitored by 50 Continuous Air Quality Monitoring Stations. Total suspended particulate, Particulate Matter (PM10) and several heavy metals including lead were measured once in every six days at 33 Manual Air Quality Stations. The air quality trend was then computed by averaging direct measurements from the monitoring sites on a yearly basis.

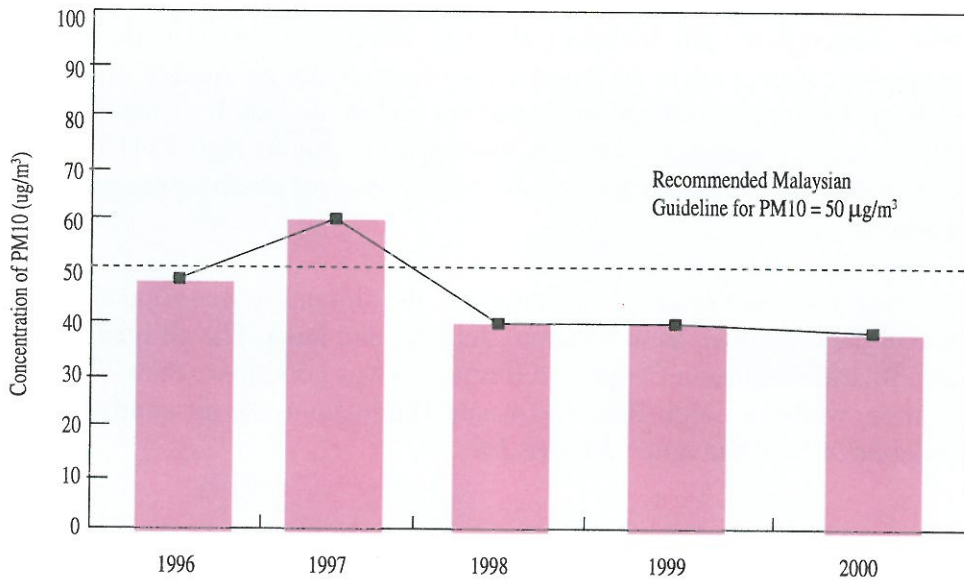


Figure 5 Malaysia : Annual Average PM10 Concentration, (1996-2000)

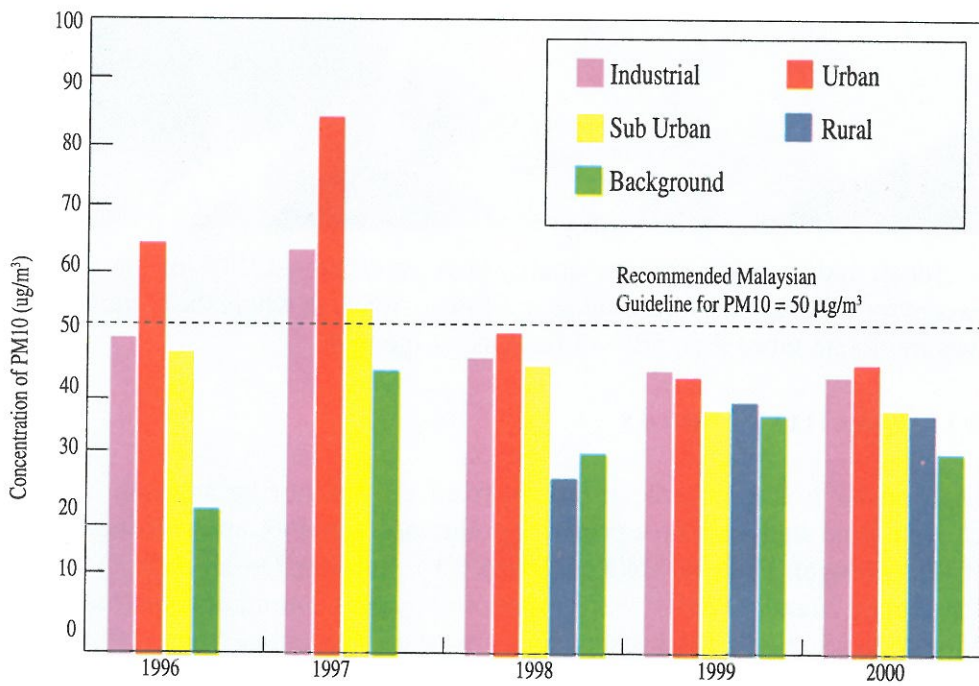


Figure 5(a) Malaysia : Annual Average PM10 Concentration by Landuse, (1996-2000)

Particulate Matter (PM 10) Levels

Respirable particles less than 10μ in size generally termed “particulate matter”, originate from stationary, mobile and natural sources. Motor vehicular fuel combustion, power generation, industrial facilities and open burning activities are predominant sources of particulate matter. In addition, over the last several years between July to September of each year, significant amount of fine particulate matter from uncontrolled biomass burning for land clearing in a neighbouring country had adversely affected the air quality in many parts of the country.

Accumulation of this pollutant in the respiratory system can cause numerous health effects related to respiratory and lung functions. Sensitive groups such as the elderly, individuals with asthma and cardiopulmonary diseases

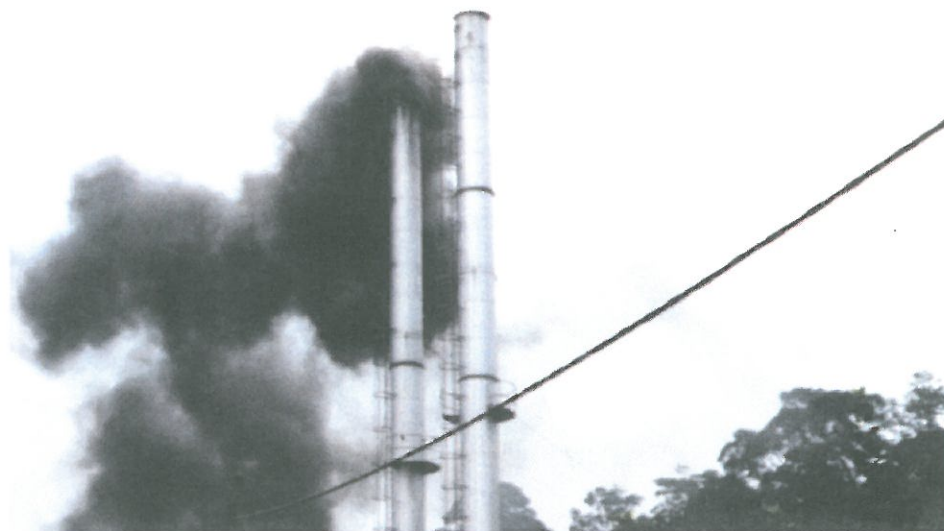


Photo 4:
Industrial Air Pollution
(DOE Photo Library)

and children are at greater risk of such health effects. High levels of PM10 in the atmosphere is also a major cause of reduced visibility and hazy conditions especially during the dry season.

PM10 remained the prevalent pollutant throughout many areas in Malaysia. The annual average levels of PM10 in the ambient air between 1996 to 2000 is shown in **Figure 5**. Except in 1997, atmospheric PM10 levels were below the recommended Malaysian Air Quality Guideline ($50 \mu\text{g}/\text{m}^3$). **Figure 5 (a)** describes the breakdown of annual average PM10 levels at various categories of land use where monitoring stations are located. Generally, PM10 levels are higher in urban and industrial areas due to the much greater number of mobile and industrial sources as compared to suburban and rural areas.

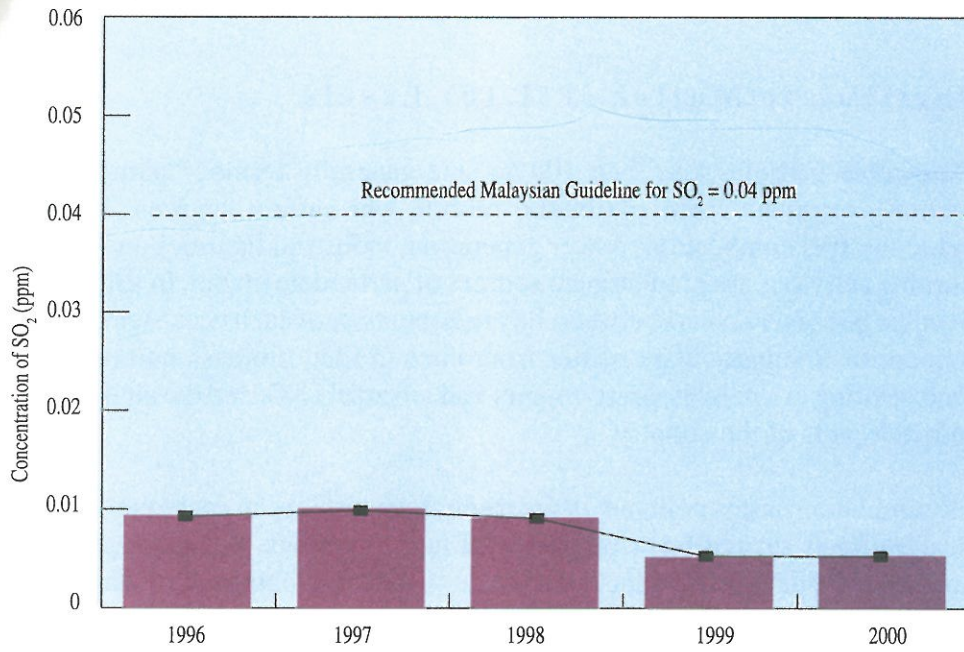


Figure 6 Malaysia : Annual Average SO₂ Concentration, (1996-2000)

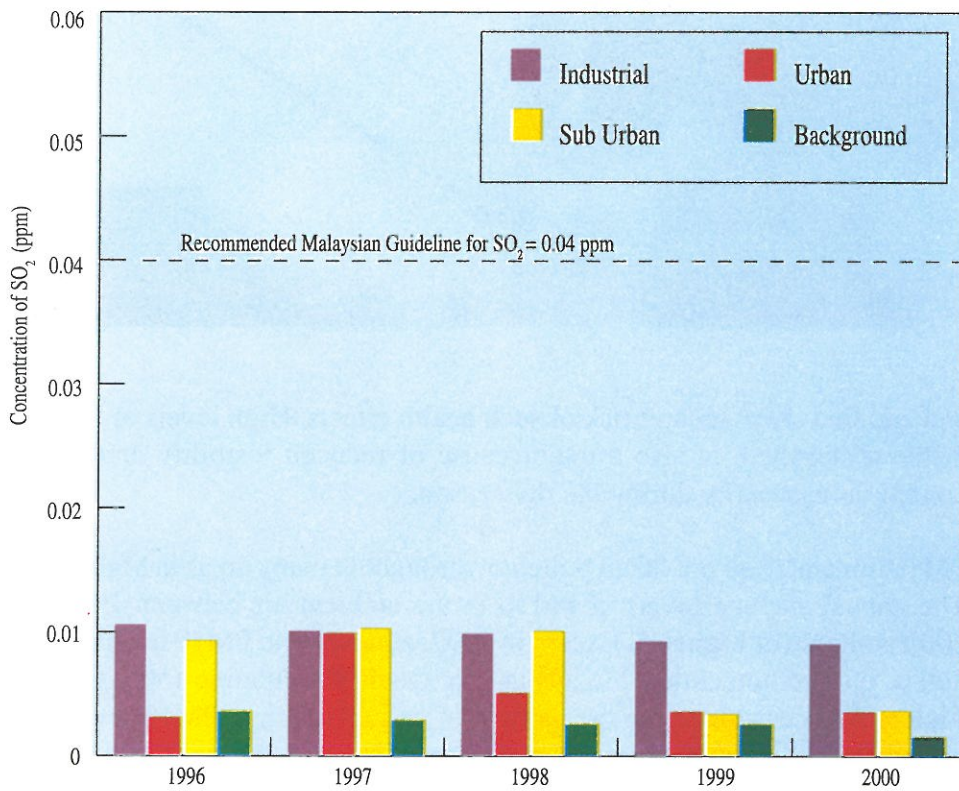


Figure 6(a) Malaysia : Annual Average SO₂ Concentration by Landuse, (1996-2000)

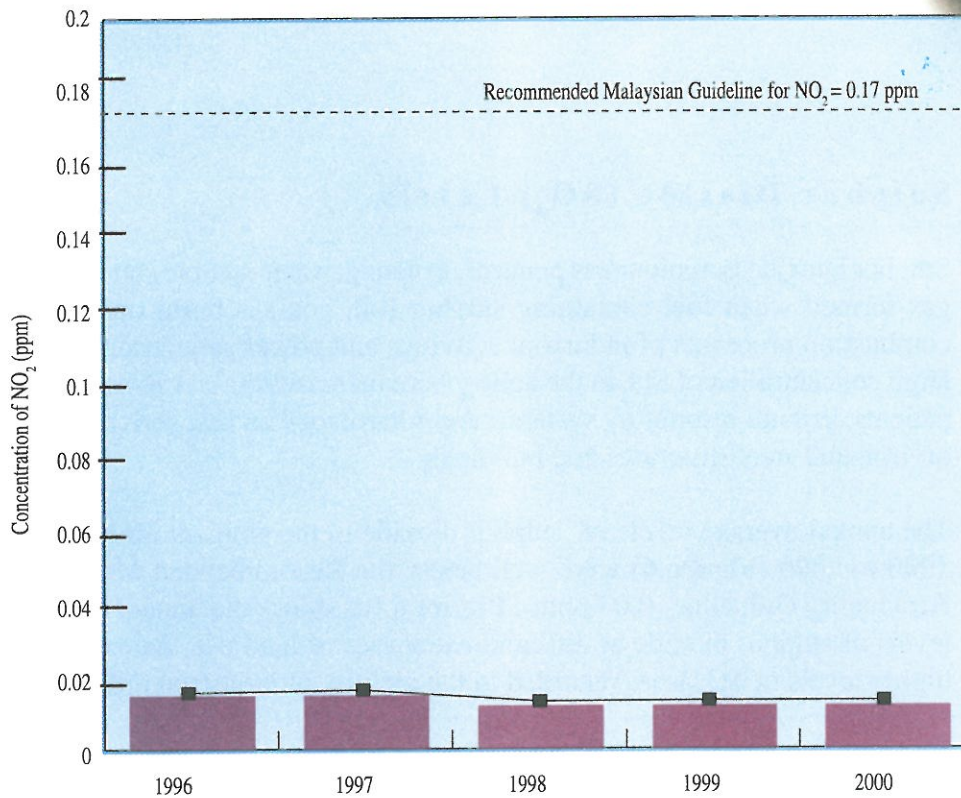


Figure 7 Malaysia : Annual Average NO₂ Concentration, (1996-2000)

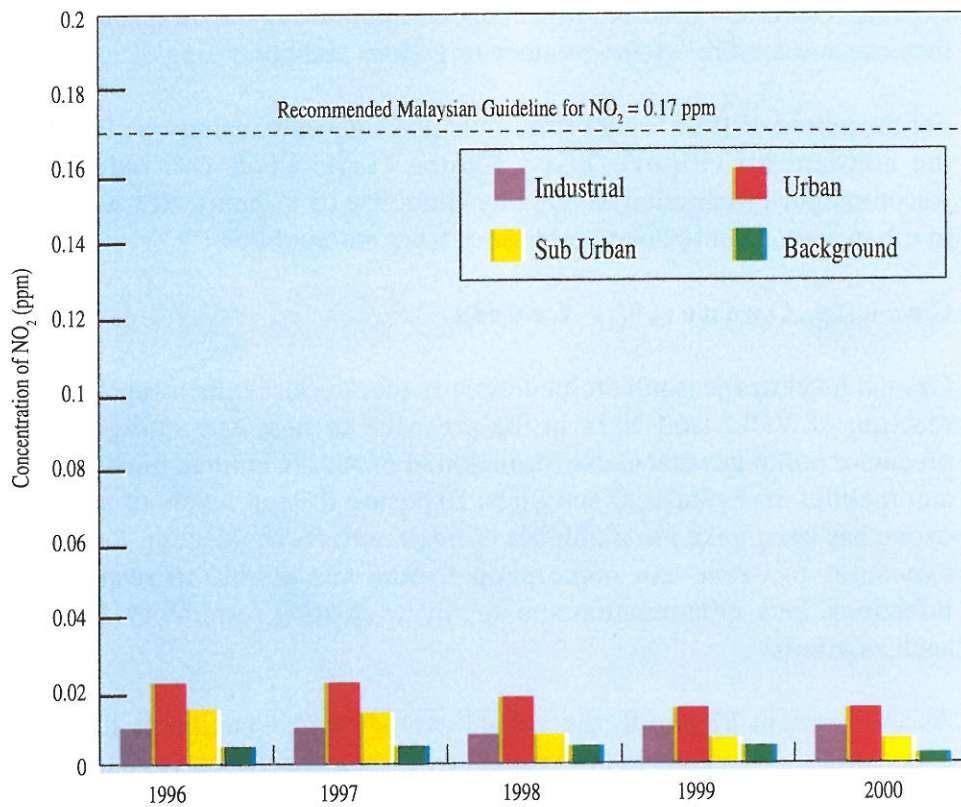


Figure 7(a) Malaysia : Annual Average NO₂ Concentration by Landuse, (1996-2000)

Sulphur Dioxide (SO₂) Levels

Sulphur Dioxide is a colourless pungent, irritating, water-soluble and reactive gas formed when fuel-containing sulphur (oil, coal) is burnt during the combustion processes of industrial activities and power generation plants. High concentration of SO₂ in the atmosphere increases the risk to asthmatic patients, irritates respiratory system, causes harm to plant life, and corrosion of iron and steel structures and buildings.

The annual average levels of sulphur dioxide in the ambient air between 1996 to 2000 (**Figure 6**) were well below the Recommended Malaysian Air Quality Guideline (0.04 ppm). **Figure 6 (a)** shows the annual average levels of sulphur dioxide at different categories of land use. As expected, higher levels of SO₂ were recorded in the vicinity of industrial areas.

Nitrogen Dioxide (NO₂) Levels

Nitrogen dioxide (NO₂) is a reddish brown, highly reactive gas that is formed by the oxidation of nitric oxide (NO). The major sources of NO₂ emissions are high temperature combustion processes such as those occurring in automobiles and power plants. Short term exposure to NO₂ may lead to changes in airway responsiveness and lung functions in individuals with existing respiratory illnesses especially children. Long term exposure may increase susceptibility to respiratory infections and other lung diseases.

For the period of 1996 to 2000, the annual average concentration of NO₂ in the ambient air (**Figure 7** and **Figure 7(a)**), were well below the Recommended Malaysian Air Quality Guideline (0.17 ppm). NO₂ was high in urban areas mainly due to emissions from automobiles.

Ground Ozone (O₃) Levels

Ground level ozone is not emitted directly into the air but is formed by the reaction of VOCs and NO_x in the presence of heat and sunlight. The precursor pollutants that cause formation of ozone are emitted mainly from automobiles and industrial activities. Exposure to high levels of ambient ozone has been linked to a number of health effects of concern. Repeated exposures to ozone can make people more susceptible to respiratory infections, lung inflammation and aggravate existing respiratory diseases such as asthma.

As indicated in **Figure 8**, the annual average daily maximum 1 hourly concentrations of ozone in the ambient air recorded between 1996 to 2000, were below the Recommended Malaysian Air Quality Guideline (0.1 ppm). **Figure 8 (a)** describes the breakdown of ozone levels for various land use categories during this period. Higher levels of Ozone were recorded in urban areas due to the presence of precursor ozone gases namely NO_x emitted mainly from motor vehicles.

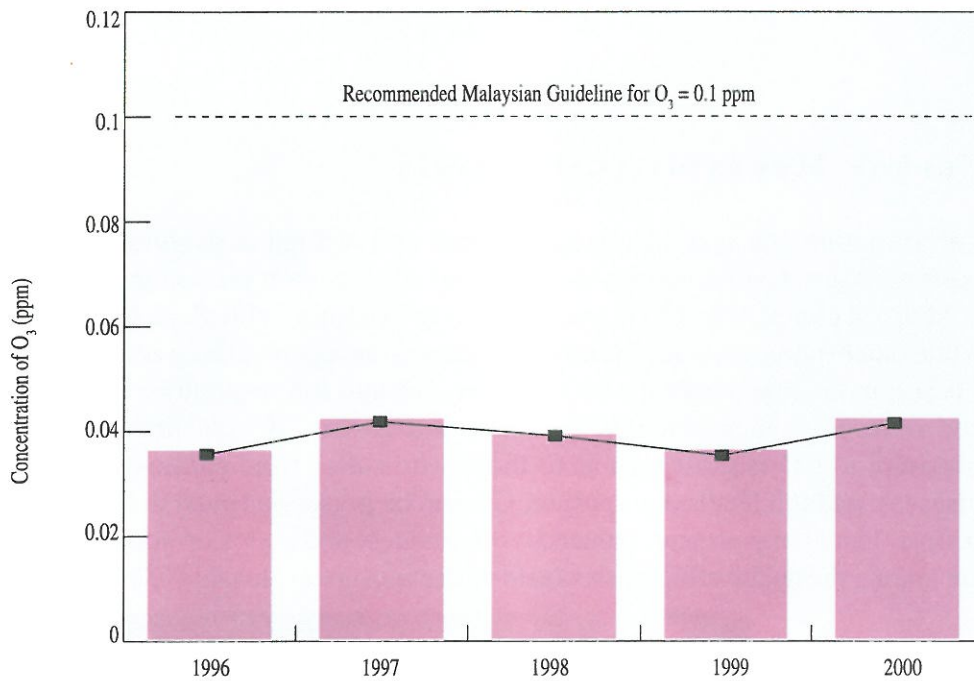


Figure 8 Malaysia : Annual Average Daily Maximum 1 Hour O₃ Concentration, (1996-2000)

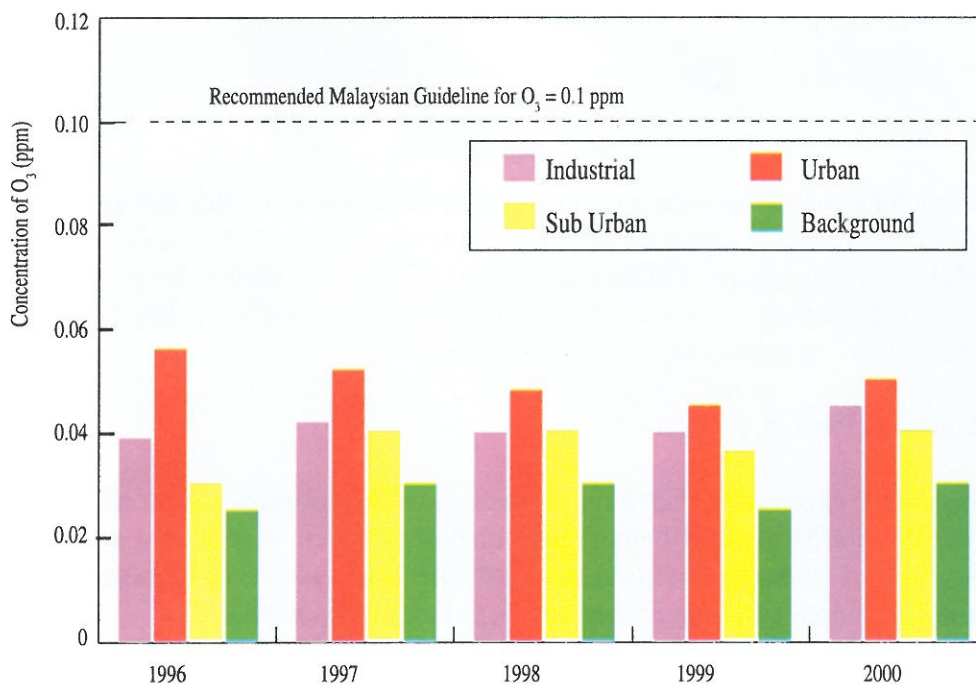


Figure 8(a) Malaysia : Annual Average Daily Maximum 1 Hour O₃ Concentration by Landuse, (1996-2000)

Carbon Monoxide (CO) Levels

Carbon monoxide is a colorless, odorless and at high concentration, a poisonous gas. Carbon monoxide is formed when carbon present in fuel is not burned completely. CO is emitted mainly by motor vehicular exhausts, while other sources include industrial processes and open burning activities. Carbon monoxide enters the bloodstream through the respiratory system and reduces oxygen delivery to organs and tissues. 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 to healthy people. Visual impairment, reduced work capacity and poor learning ability are among the health effects associated with exposure to elevated CO levels.



*Photo 5:
LRT for reducing
urban air pollution
(DOE Photo Library)*

The annual 8-hourly average concentrations of carbon monoxide throughout the country measured between 1996 to 2000 were below the Recommended Malaysian Air Quality Guideline (9 ppm) (**Figure 9**). Higher levels were recorded in urban areas due to higher density of motor vehicles. **Figure 9(a)** shows CO concentrations for various categories of land use.

Lead (Pb) Levels

Excessive exposure to Lead may cause neurological impairment such as mental retardation and behavioural disorders. Even at low doses, lead exposure is associated with damage to the nervous systems of foetuses and young children resulting in learning deficiency and lowered IQ.

The presence of lead in motor vehicular fuels has been the main source of lead (Pb) emissions into the atmosphere. In the eighties, atmospheric lead levels were high. However, as a result of environmental regulations to reduce lead concentrations in petrol and the promotion of use of unleaded petrol since 1991, ambient Pb levels have declined significantly. In 2000, the average level of lead monitored in the Klang Valley was only at 0.1 $\mu\text{g}/\text{m}^3$. (**Figure 10**)

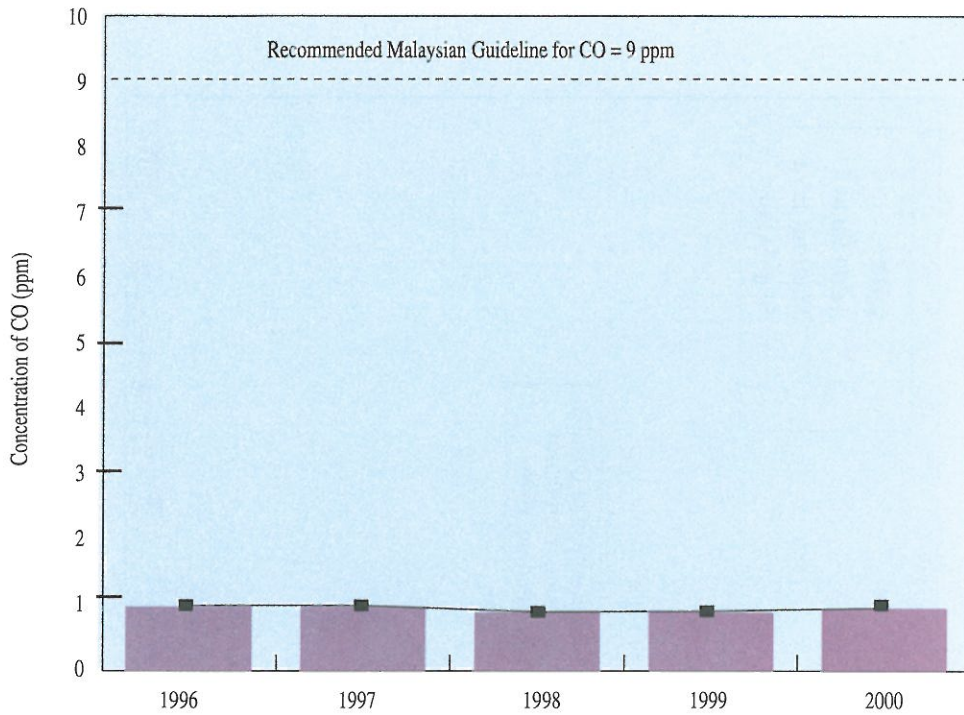


Figure 9 Malaysia : Annual 8- Hourly Average CO Concentration, (1996-2000)

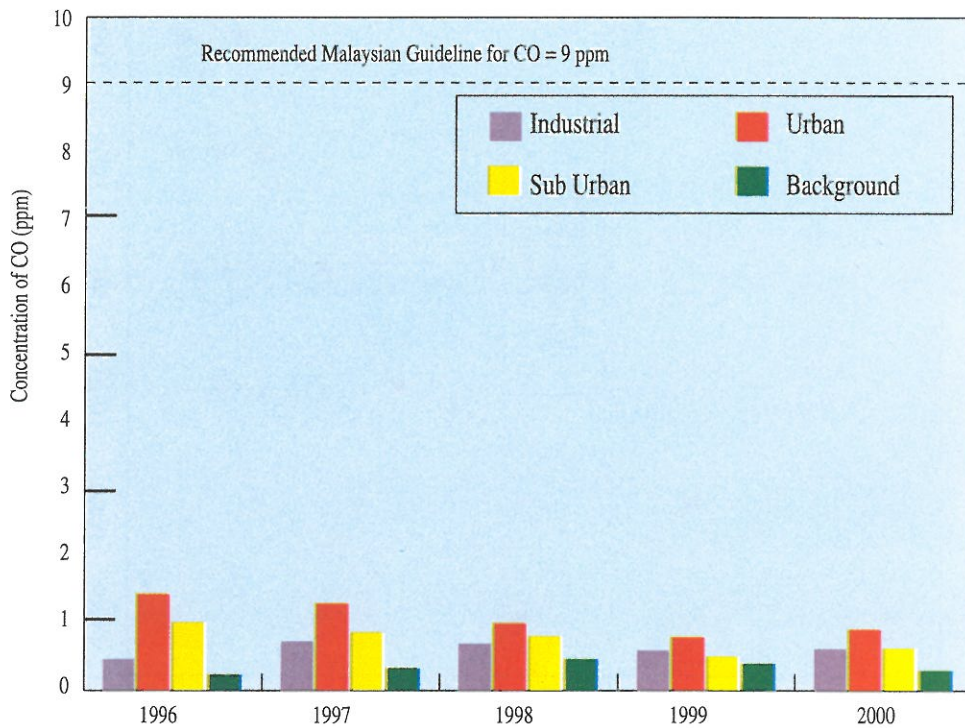


Figure 9(a) Malaysia : Annual 8-Hourly Average CO Concentration by Landuse, (1996-2000)

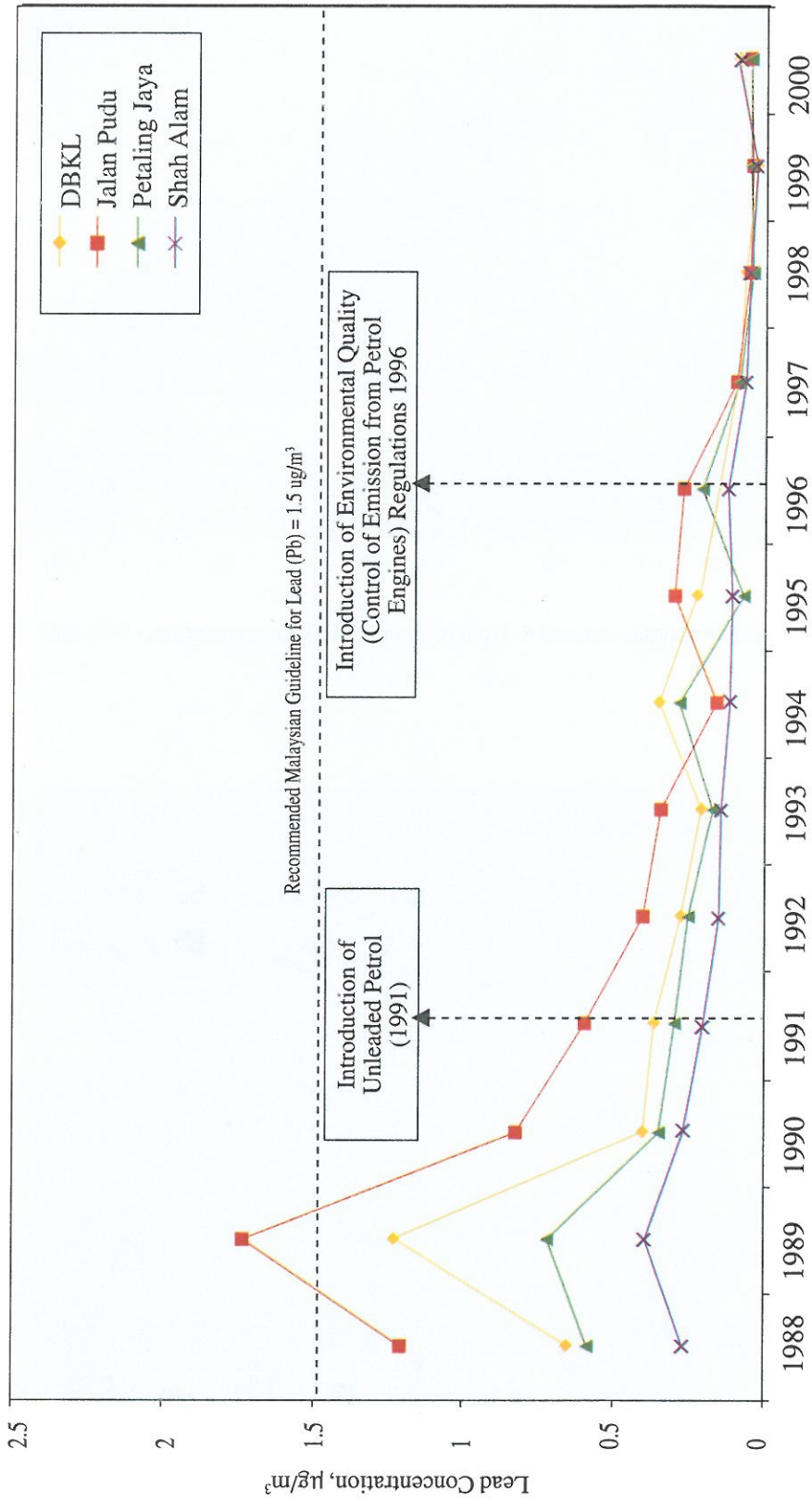


Figure 10 Malaysia : Ambient Lead Concentration in the Klang Valley, (1998-2000)

MALAYSIA

Environmental
Quality Report



NOISE MONITORING



NOISE MONITORING

Noise monitoring carried out in the year 2000 concentrated mainly on assessing the impact of noise exposure to sensitive noise receivers at premises such as schools and hospitals in Kuala Lumpur, Port Dickson, Melaka, Seberang Perai, Kuala Terengganu and Kota Bahru . Data obtained from the noise monitoring were then assessed against the values recommended by the World Health Organization (WHO)

The noise levels recorded at selected school premises in Kuala Lumpur, Port Dickson, Melaka, Kota Bahru and Kuala Terengganu were found to be between **57.8 dB(A)** to **71.8 dB(A)** during day time (7am to 10pm) which exceeded the WHO recommended level for day time exposure (55 dB(A)). Sekolah Kebangsaan Batu in Kuala Lumpur recorded the highest noise level compared to schools in other areas (**Figure 11**).



*Photo 6:
Major urban noise sources
(DOE Photo Library)*

*Noise level monitoring
(DOE Photo Library)*

Similarly the measurements carried out at selected hospital premises also recorded noise levels that exceeded the limits recommended by WHO, except for the Kuala Terengganu Hospital. The noise levels recorded were between **53.8 dB(A)** to **66.6 dB(A)** during day time (7.00 am to 10.pm) as compared to 55dB(A) set by WHO. The General Hospital in Kuala Lumpur recorded the highest noise level (**Figure 12**).

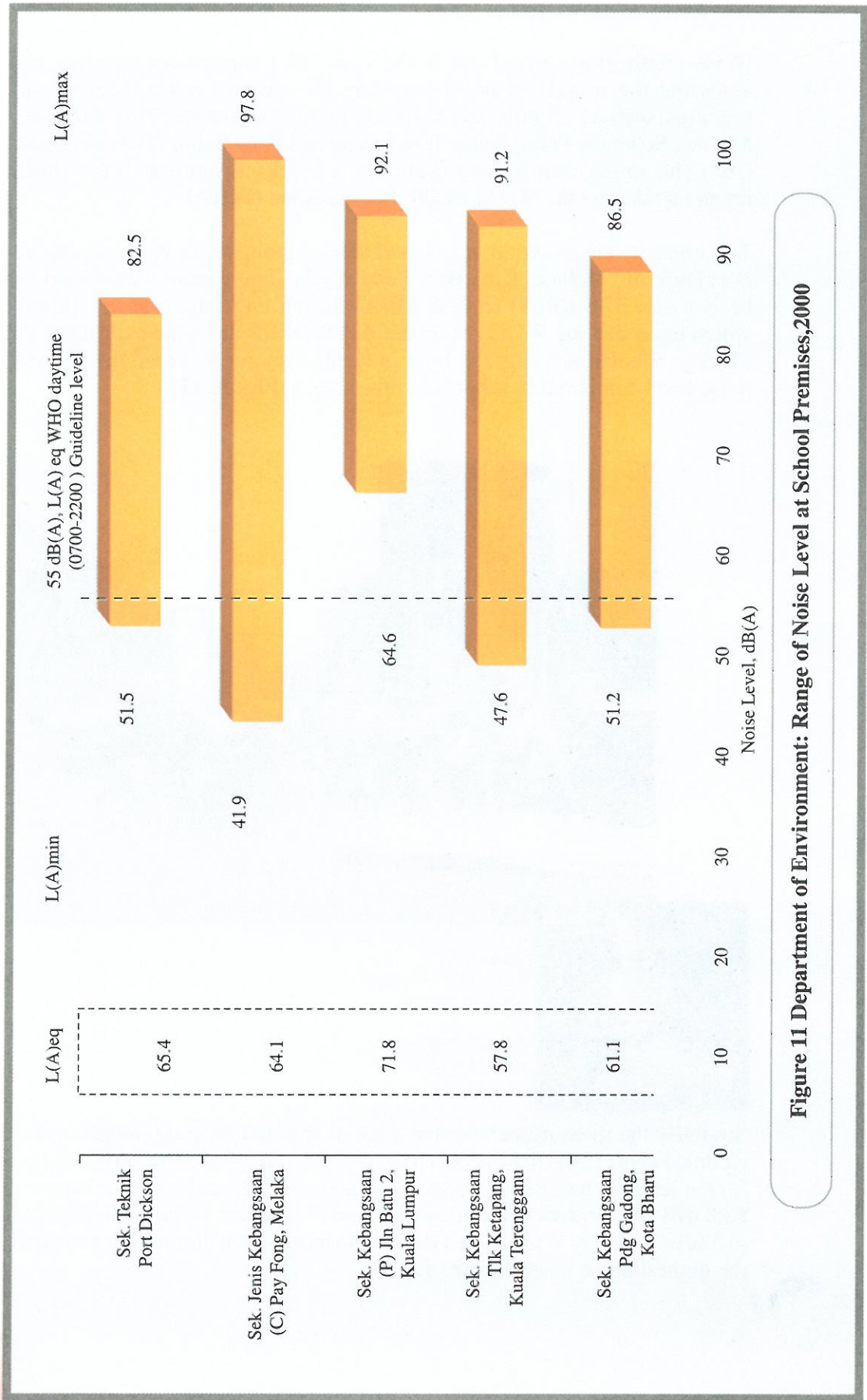


Figure 11 Department of Environment: Range of Noise Level at School Premises, 2000

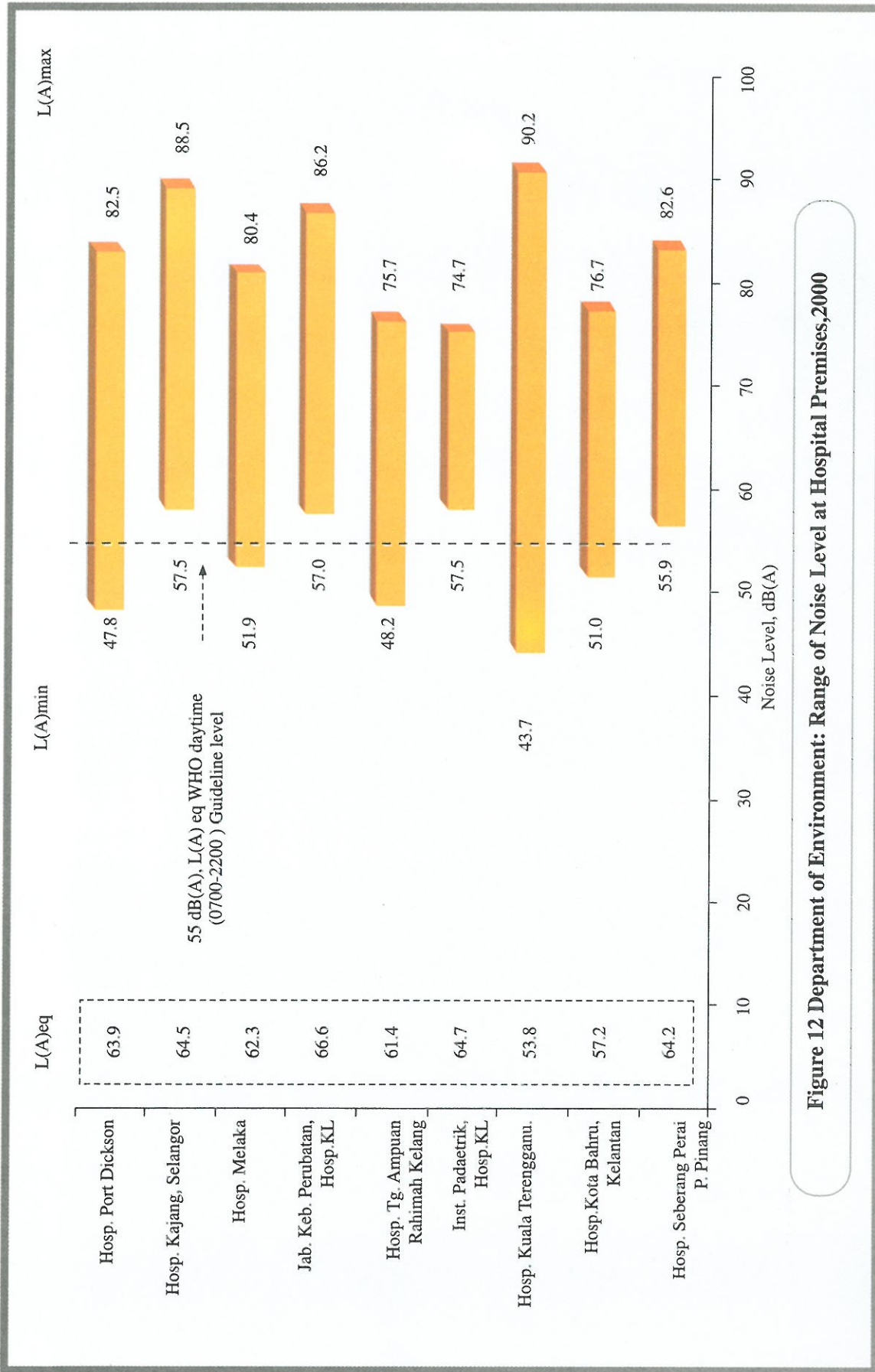
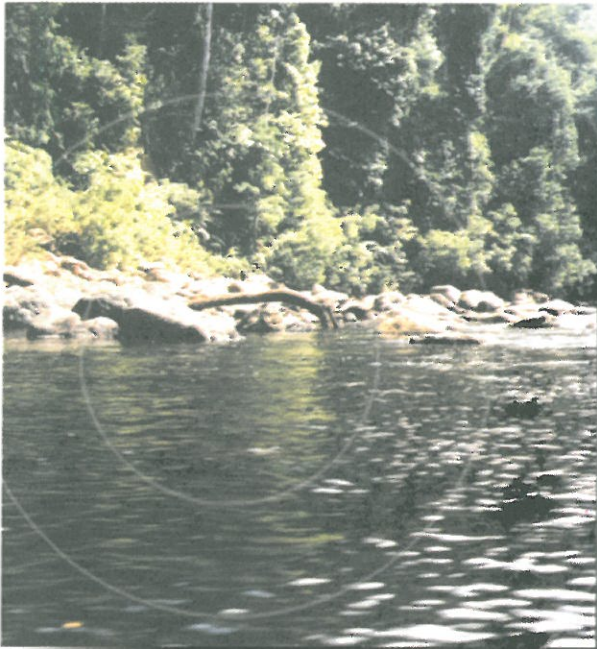


Figure 12 Department of Environment: Range of Noise Level at Hospital Premises, 2000



MALAYSIA

Environmental
Quality Report



RIVER WATER QUALITY



RIVER WATER QUALITY

Introduction

Rivers are the most important sources of water supply in Malaysia. However these water sources are being threatened more than ever in recent years due to various development activities geared to meet the needs of the growing population. Appropriate rehabilitative actions need to be planned and implemented in order to sustain the various uses of rivers.

DOE has been conducting monitoring of river water quality since 1978, primarily to establish the status of water quality, detect changes and identify pollution sources. This involves routine monitoring at predetermined



*Photo 7:
Clean clear river,
Endau Rompin National Park
(DOE Photo Library)*

stations, in-situ and laboratory analysis and data interpretation in terms of physico-chemical and biological characteristics. River water quality appraisal is based on the Water Quality Index (WQI) involving parameters like Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammoniacal Nitrogen (NH_3N), Suspended Solids (SS) and pH. The WQI serves as a basis for assessment relating to pollution categorization and designated classes of beneficial uses in accordance with the Interim National Water Quality Standards for Malaysia (INWQS). (ANNEX)

River Water Quality Status

For the year 2000, a total of 901 stations located within 120 river basins were monitored. Out of these 901 monitoring stations, 388 (43.1%) were found to be clean, 391 (43.4%) slightly polluted and 122 (13.5%) polluted. (Table 1.0(a), (b), (c)). Stations located upstream were generally clean,



*Photo 8:
Land clearing causing
river siltation.
(DOE Photo Library)*

while those downstream were either slightly polluted or polluted. In terms of water quality on the basis of river basins, 34 river basins (28.3%) were clean compared to 35 river basins in 1999; 74 (61.7 %) slightly polluted compared to 72 in 1999; and 12 (10 %) polluted compared to 13 in 1999 (**Table 1.0(c)**)(Annex).

In addition, 10 automatic water quality-monitoring stations at strategic locations along major rivers had been installed to detect river water quality changes on a continuous basis. Water quality exceeding the ambient standard for specific parameters can be transmitted real-time to DOE to enable immediate investigation to be conducted on suspected pollution sources.



*Photo 9:
Good land clearing
practice.
(DOE Photo Library)*



*Photo 10:
River with high level of
suspended solids.
(DOE Photo Library)*

These stations were located at Sungai Perai, Sungai Perak, Sungai Skudai, Sungai Kuantan, Sungai Terengganu, Sungai Selangor, Sungai Kelang, Sungai Linggi, Sungai Melaka and Sungai Sarawak. Six of these 10 stations were located upstream of water intake points.

Figure 13 illustrates the status of river water quality in relation to major pollution sources, whereby 15% of the river basins were polluted by biochemical oxygen demand (BOD) caused by sewage and discharges from agro-based and manufacturing industries; 28% of river basins were polluted by ammoniacal nitrogen ($\text{NH}_3\text{-N}$) from sewage that include livestock farming and domestic sewage; while 44% by suspended solids (SS) due to earthworks and land-clearing activities. The corresponding figures in 1999 were 26%, 28% and 38% for BOD, $\text{NH}_3\text{-N}$ and SS respectively. The BOD improvement could be attributed to the increased numbers of refurbished



*Photo 11:
Urban drainage
(DOE Photo Library)*

Table 1.0 (a) Malaysia: Water Quality Status within Clean River Basins, 2000

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS
KEDAH (PLANGKAWI)	MELAKA	01PL	3	89	KISAP	89	C	II
					MELAKA	87	C	II
					PETANG	91	C	II
KEDAH	KEDAH	03	6	82	KEDAH	61	SP	III
					PADANG TERAP	85	C	II
					PEDU	87	C	II
					TEKAI	85	C	II
KEDAH/PULAU PINANG	MUDA	05	9	81	JERUNG	73	SP	III
					KETIL	87	C	II
					MUDA	81	C	II
					TAWAR	86	C	II
PERAK	TEMERLOH BERUAS	10T 11	2	82	TEMERLOH	82	C	II
			4	83	BRUAS	77	SP	II
					ROTAN	89	C	II
SELANGOR	SELANGOR	16	9	81	BATANG KALI	85	C	II
					KANCING	89	C	II
					KERLING	91	C	II
					SELANGOR	79	SP	II
					SEMBAH	67	SP	III
					SERENDAH	85	C	II
JOHOR	SEDILI BESAR	30A	13	83	AMBAT	85	C	II
					DOHOL	88	C	II
					MUPUR	65	SP	III
					SEDILI BESAR	81	C	II
					SEMANGGOTKANAN	88	C	II
					SEMANGGOT KIRI	86	C	II
					TEMUBOR KANAN	89	C	II
JOHOR	MERSING ANAK ENDAU	31A	1	86	MERSING	86	C	II
		32AE	2	81	ANAK ENDAU	81	C	II
PAHANG	LEPAR	35L	10	84	ANAK SG. LEPAR	71	SP	III
					BELAYAR	89	C	II
					BERKAPOR	89	C	II
					CHINI	75	SP	III
					LEPAR	86	C	II
					T. PAYA BUNGOR	86	C	II
					TASIK CHINI	82	C	II
					MENTIGA	81	C	II
					PAHANG	84	C	II
					BATU	84	C	II
	BENTONG	85	C	II				
	BENUS	87	C	II				
	BILUT	82	C	II				
	JELAI	82	C	II				
	JEMPOL	86	C	II				
	JENGKA	80	SP	II				
	KELAU	86	C	II				
	KERTAM	80	SP	II				
	KOYAN	89	C	II				
	KUNDANG	75	SP	III				
	LIPIS	85	C	II				
	LUIT	86	C	II				
	MARAN	86	C	II				
	PAHANG	84	C	II				
	PENJURING	91	C	II				
	PERTANG	86	C	II				
	PERTING	84	C	II				
	SEMANTAN	82	C	II				
	SIAM	80	SP	II				
	TANGLIR	85	C	II				
	TEKAL	80	SP	II				

Table 1.0 (a) Malaysia: Water Quality Status within Clean River Basins, 2000 (Continued)

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS	
PAHANG	PAHANG				TEKAM	80	SP	II	
					TELANG	87	C	II	
					TELEMONG	88	C	II	
					TERANUM	90	C	II	
					TERAS	90	C	II	
TERENGGANU	KERTIH PAKA	39K	1	87	KERTIH	87	C	II	
		40	10	83	BESUL	85	C	II	
	DUNGUN	41	4	86	PAKA	83	C	II	
					RASAU	80	SP	II	
					RENGAT	85	C	II	
					DUNGUN	89	C	II	
	TERENGGANU	43	9	85	TELEMBOH	82	C	II	
					BERANG	88	C	II	
					NERUS	85	C	II	
	SETIU	44	3	82	PUEH	85	C	II	
					TERENGGANU	82	C	II	
	BESUT	46	4	85	SETIU	86	C	II	
					TARONG	79	SP	II	
						BESUT	89	C	II
					JERTIH	81	C	II	
KELANTAN	KELANTAN	48	38	84	ARING	82	C	II	
					BELATOP	77	SP	II	
					BER	88	C	II	
					BEROK	78	SP	II	
					BETIS	79	SP	II	
					CHIKU	87	C	II	
					GALAS	81	C	II	
					KELANTAN	81	C	II	
					KELESA	88	C	II	
					KERAK	87	C	II	
					KERILLA	89	C	II	
					KETIL	90	C	II	
					NAL	89	C	II	
					PEHI	86	C	II	
					PENKALAN CHEPA	77	SP	II	
					PENKALAN DATU	79	SP	II	
					PERGAU	87	C	II	
					PERTOK	83	C	II	
					RELAI	87	C	II	
	GOLOK	49	4	81	GOLOK	83	C	II	
					TASIK GARU	79	SP	II	
	SARAWAK	KAYAN	50	4	84	KAYAN	82	C	II
						SEMATAN	90	C	II
SIMILAJAU		62	1	83	SIMILAJAU	83	C	II	
					TRUSAN	85	C	II	
LAWAS		70	2	85	LAWAS	85	C	II	
SABAH	MENGALONG	71	3	82	LAKUTAN	81	C	II	
					LINGKUNGAN	82	C	II	
					MENGALONG	83	C	II	
	PADAS	72	7	85	BUNSIT	91	C	II	
					LIAWAN	92	C	II	
					PADAS	80	SP	II	
					PANGATAN	84	C	II	
	PAPAR	75	2	86	TANDULU	91	C	II	
					PAPAR	86	C	II	
	DAMIT/TUARAN	77	6	87	DAMIT	88	C	II	
					SONG SAI	87	C	II	
	KEDAMAIAN	78	3	86	TUARAN	86	C	II	
					TEMPASUK	87	C	II	
				TENGHILAN	84	C	II		

Table 1.0 (a) Malaysia: Water Quality Status within Clean River Basins, 2000 (Continued)

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS	
SABAH	BENGKOKA SUGUT	80	1	85	BENGKOKA	85	C	II	
		83	6	88	BONGKUD	88	C	II	
				88	LOHAN	87	C	II	
	LABOK/LIWAGU	84	8	85	88	MERALI	87	C	II
					88	SUGUT	88	C	II
					87	KINIPIR	87	C	II
					85	LIWAGU	85	C	II
					88	MALIAU	88	C	II
					80	SAPI	80	SP	II
	KAYA TAWAU	85	1	84	89	SUALONG	89	C	II
					84	MOUNAD	84	C	II
					82	APAS	80	SP	II
					82	BALUNG	82	C	II
					82	TAWAU	82	C	II

NOTE:

1. WQI BASED ON 6 MAJOR PARAMETERS: BOD, COD, SS, PH, DO, NH₃-N
2. RIVER WATER QUALITY STATUS: C : CLEAN, SP : SLIGHTLY POLLUTED, P : POLLUTED
3. RIVER CLASS BASED ON INWQS

Table 1.0 (b) Malaysia: Water Quality Status within Slightly Polluted River Basins, 2000

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS
PERLIS	PERLIS	01	10	78	ARAU	65	SP	III
					JARUM	85	C	II
					JERNIH	84	C	II
					KOK MAK	81	C	II
					NGULANG	79	SP	II
					PERALIT	86	C	II
					PERLIS	64	SP	III
					SERAI	73	SP	III
					TASOH	79	SP	II
PULAU PINANG	PERAI	06P	22	62	AIR MELINTAS	40	P	IV
					JARAK	68	SP	III
					KELADI	66	SP	III
					KEREH	55	P	III
					KUBANG SEMANG	60	SP	III
					KULIM	80	SP	II
					PERAI	66	SP	III
					SELUANG	40	P	IV
					SELUANG BAWAH	46	P	IV
PULAU PINANG / PERAK	KERIAN	08	10	72	KECHIL	68	SP	III
					KERIAN	75	SP	III
					SELAMA	67	SP	III
					SERDANG	81	C	II
PERAK	KURAU	09	5	76	ARA	85	C	II
					KURAU	74	SP	III
	SEPETANG	10	10	73	BATU TEGUH	77	SP	II
					JANA	87	C	II
					LARUT	69	SP	III
					LIDIN	64	SP	III
					MALAI	65	SP	III
					SEPETANG	74	SP	III
					TUPAI	69	SP	III
	RAJA HITAM	12	4	60	DERHAKA	56	P	III
					RAJA HITAM	65	SP	III
	WANGI/DERALIK	12W	6	69	DERALIK	67	SP	III
					MANJONG	76	SP	III
					WANGI	63	SP	III
	PERAK	13	53	77	BATANG PADANG	80	SP	II
					BIDOR	79	SP	II
					CHENDERANG	89	C	II
					CUAR	84	C	II
					KAMPAR	85	C	II
					KANGSAR	87	C	II
					KEPAYANG	75	SP	III
					KERDAH	79	SP	II
					KINTA	68	SP	III
					KLAH	79	SP	II
					KLIAN BARU	67	SP	III
					KUANG	85	C	II
					PARI	60	SP	III
PELUS					84	C	II	

Table 1.0 (b) Malaysia: Water Quality Status within Slightly Polluted River Basins, 2000 (Continued)

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS	
PERAK					PERAK	85	C	II	
					PINJI	61	SP	III	
					RAIA	83	C	III	
					SELUANG	74	SP	III	
					SEROKAI	61	SP	III	
					SUNGKAI	80	SP	II	
					SUNGKAI MATI	69	SP	III	
					TUMBOH	67	SP	III	
PERAK/SELANGOR	BERNAM	14	10	79	BERNAM	74	SP	III	
					SLIM	85	C	II	
					TEROLAK	88	C	II	
SELANGOR	TENGI LANGAT	15 19	2 21	75 68	TENGI	75	SP	III	
					ANAK CHUAU	78	SP	II	
					BATANG BENAR	61	SP	III	
					BATANG LABU	69	SP	III	
					BISA	90	C	II	
					CHUAU	73	SP	III	
					LANGAT	61	SP	III	
					LIMAU MANIS	34	P	IV	
					LUI	88	C	II	
					RINCHING	67	SP	III	
	SEMENYIH	78	SP	II					
	SEPANG	20	3	66	SEPANG	66	SP	III	
	NEGRI SEMBILAN	LUKUT	20J 21	1 15	73 75	LUKUT	73	SP	III
						BATANG PENAR	61	SP	III
		LINGGI					CHEMBONG	84	C
KEPAYONG							76	SP	III
KUNDUR BESAR							85	C	II
LINGGI							70	SP	III
PEDAS							84	C	II
REMBAU							83	C	II
SIMIN							73	SP	III
TEMIANG	74	SP	III						
MELAKA	MELAKA	22	11	72	BTG.MELAKA	79	SP	II	
					DURIAN TUNGGAL	86	C	II	
					MELAKA	68	SP	III	
					PUTAT	56	P	III	
					TAMPIN	85	C	II	
	DUYONG KESANG	23 24	3 8	72 70	DUYONG	72	SP	III	
					CHOHONG	86	C	II	
					KESANG	75	SP	III	
	MERLIMAU	55	P	III					
JOHOR	MUAR	25	43	75	GEMENCHEH	82	C	II	
					JUASSEH	85	C	II	
					KELAMAH	60	SP	III	
					LABIS	77	SP	II	
					MERBUDU	62	SP	III	
					MERLIMAU	63	SP	III	
					MUAR	76	SP	III	
					P. MENKUANG	92	C	II	

Table 1.0 (b) Malaysia: Water Quality Status within Slightly Polluted River Basins, 2000 (Continued)

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS
JOHOR	BATU PAHAT	26	23	75	PALONG	79	SP	II
					SEGAMAT	86	C	II
					SENARUT	68	SP	III
					SEROM	50	P	IV
					SPG. LOI	74	SP	III
					TEMARONG	87	C	II
					TENANG	64	SP	III
					AMRAN	73	SP	III
					BATU PAHAT	60	SP	III
					BEKOK	79	SP	II
					BERLIAN	79	SP	II
					CHAAH	83	C	II
					LENIK	80	SP	II
					MEREK	85	C	II
					MERPO	83	C	II
					SEMBERONG	72	SP	III
					SIMPANG KANAN	60	SP	III
					SIMPANG KIRI	63	SP	III
					BENUT	70	SP	III
					PT. HAJI YASSIN	66	SP	III
					ULU BENUT	84	C	II
					PONTIAN BESAR	66	SP	III
					AYER MERAH	50	P	IV
	PONTIAN BESAR	69	SP	III				
	PONTIAN KECIL	70	SP	III				
	SKUDAI	67	SP	III				
	TEBRAU	56	P	III				
	PLENTONG	56	P	III				
	TEBRAU	81	C	II				
	RAMBAH	60	SP	III				
	JOHOR	70	SP	III				
	ANAK SG. SAYONG	70	SP	III				
	BERANGAN	78	SP	II				
	BKT. BESAR	48	P	IV				
	CHEMANGAR	77	SP	II				
	JOHOR	78	SP	II				
	LAYANG	87	C	II				
	LAYAU KIRI	81	C	II				
	LEBAM	77	SP	II				
	LINGGIU	84	C	II				
	PENGGELI	84	C	II				
	REMIS	81	C	II				
	SANTI	79	SP	II				
	SAYONG	77	SP	II				
SEBOL	80	SP	II					
SEMANGER	83	C	II					
SEMENCHU	80	SP	II					
SENING	65	SP	III					
SERAI	73	SP	III					
TELOR	87	C	II					
TEMON	75	SP	II					
TIRAM	73	SP	III					
	27B	7	71					
	28A	5	64					
	28B	2	70					
	28C	8	67					
	28D	5	76					
	28G	2	60					
	29	44	76					

Table 1.0 (b) Malaysia: Water Quality Status within Slightly Polluted River Basins, 2000 (Continued)

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS
JOHOR	SEDILI KECIL	30B	5	69	ANAK SEDILI KECIL	37	P	IV
					BAHAN	76	SP	III
					SEDILI KECIL	77	SP	II
					PALOI	76	SP	III
					JEMALUANG	79	SP	II
	ENDAU	32	29	76	A.S. SEMBERONG	77	SP	II
					DENGAR	81	C	II
					ENDAU	82	C	II
					JEBONG	74	SP	III
					LENGA	54	P	III
					LENGGOR	82	C	II
					MAMAI	80	SP	II
					MELANTAI	74	SP	III
					MENKIBOL	78	SP	II
					PALOH	84	C	II
					PAMOL	65	SP	III
					SEMBERONG	81	C	II
					SINGOL	60	SP	III
TAMOK	85	C	II					
PAHANG	PONTIAN	32/33	3	75	PONTIAN	80	SP	II
	ROMPIN	33	18	79	SEPAYANG	66	SP	III
					AUR	86	C	II
PAHANG	BEBAR/MERCHONG	34	8	78	BAKAR	65	SP	III
					JEKATIH	79	SP	II
					JERAM	87	C	II
					KEPASING	80	SP	II
					KERATONG	77	SP	II
					PUKIN	80	SP	II
					REKOH	77	SP	II
					ROMPIN	80	SP	II
					BEBAR	66	SP	III
					KELAYAT	85	C	II
					MERBA	80	SP	II
					MERCHONG	60	SP	III
	SERAI	80	SP	II				
	TEMIANG	84	C	II				
	SERTING	35	7	68	MOKEK	73	SP	III
					SERTING	66	SP	III
	BERA	35B	5	77	BERA	75	SP	III
					TASIK BERA	76	SP	III
	BERTAM	35CH	10	80	TRIANG	83	C	II
					BERTAM	76	SP	III
					BURUNG	85	C	II
					HABU	84	C	II
					LENGGOK	78	SP	II
RINGLET					78	SP	II	
TELOM					79	SP	II	
TERLA	82	C	II					
KUANTAN	36	11	77	TRINGKAP	79	SP	II	
				BELAT	83	C	II	
				CHARU	80	SP	II	

Table 1.0 (b) Malaysia: Water Quality Status within Slightly Polluted River Basins, 2000 (Continued)

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS				
PAHANG	BALOK/TONGGOK	37	5	68	GALING BESAR	46	P	IV				
					GALING KECIL	57	P	III				
					KENAU	84	C	II				
					KUANTAN	86	C	II				
					PINANG	77	SP	II				
					RIAU	75	SP	III				
					BALOK	65	SP	III				
					TONGGOK	71	SP	III				
CERATING	37A	1	73	CERATING	73	SP	III					
TERENGGANU	KEMAMAN	38	10	77	CHERUL	85	C	II				
					KEMAMAN	87	C	II				
					NERAM	68	SP	III				
					PERASING	81	C	II				
					RANSAN	64	SP	III				
	CHUKAI	39C	5	78	CHUKAI	80	SP	II				
					IBOK	83	C	II				
					RUANG	73	SP	III				
	IBAI	42I	3	75	IBAI	75	SP	III				
					MARANG	42M	5	76	KERAK	66	SP	III
	KEMASIN	47K	1	75	MARANG	85	C	II				
					SEMERA	47S	2	71	TEMALA	82	C	II
	SEMERA	47S	2	71	KEMASIN	75	SP	III				
SEMERA					71	SP	III					
SARAWAK	SARAWAK	51	15	79	KUAP	76	SP	III				
					MAONG KIRI	61	SP	III				
					SANTUBONG	80	SP	II				
					SARAWAK	83	C	II				
					SARAWAK KANAN	84	C	II				
					SARAWAK KIRI	82	C	II				
					SEMENGGOH	74	SP	III				
					TABUAN	78	SP	II				
					SAMARAHAN	51BS	2	75	SAMARAHAN	75	SP	III
					SADONG	52	6	80	KARANGAN	77	SP	II
									SADONG	75	SP	III
					LUPAR	53	7	77	TARAT	89	C	II
									AI	83	C	II
									LUPAR	68	SP	III
									SEKERANG	80	SP	II
	SARIBAS	54	2	76	SETERAP	82	C	II				
					UNDUP	88	C	II				
	KERIAN	55	3	73	RIMBAS	83	C	II				
					SARIBAS	70	SP	III				
	RAJANG	56	18	78	KERIAN	73	SP	III				
					SEBLAK	72	SP	III				
					BINATANG	85	C	II				
					JULAU	83	C	II				
					MERADONG	82	C	II				
	OYA	57	3	79	RAJANG	77	SP	II				
					SARIKEI	76	SP	III				
					OYA	79	SP	II				
	MUKAH	58	4	77	MUKAH	77	SP	II				

Table 1.0 (b) Malaysia: Water Quality Status within Slightly Polluted River Basins, 2000 (Continued)

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS
SARAWAK	BALINGIAN	59	2	79	BALINGIAN	79	SP	II
	TATAU	60	1	79	TATAU	79	SP	II
	KEMENA	61	3	79	KEMENA	80	SP	II
					SIBIU	76	SP	III
					SUAI	79	SP	II
	NIAH	64	5	70	NIAH	80	SP	II
					SEKALOH	63	SP	III
	SIBUTI/KABULOH	65	6	75	KABULOH	67	SP	III
					KEJAPIL	81	C	II
					SATAP	80	SP	II
					SIBUTI	78	SP	II
					LUTONG	72	SP	III
	MIRI/LUTONG	66	4	69	LUTONG	72	SP	III
MIRI					66	SP	III	
BARAM					75	SP	III	
LIMBANG	68	5	79	LIMBANG	79	SP	II	
SABAH	MEMBAKUT	73	1	80	MEMBAKUT	80	SP	II
	MOYOG	76	11	80	INANAM	83	C	II
					LIKAS	64	SP	III
					MENGGATAL	84	C	II
					MOYOG	88	C	II
					TELIPOK	66	SP	III
					BINGKONGAN	79	3	72
	KINABATANGAN	86	4	77	MENGGARIS	43	P	IV
					TANDEK	82	C	II
					KINABATANGAN	74	SP	III
	SEGAMA	87	1	80	KOYAH	83	C	II
					TENEGANG BESAR	77	SP	II
	SILABUKAN	88	2	80	SEGAMA	80	SP	II
	TINGKAYU	89	1	79	SILABUKAN	80	SP	II
	KALUMPANG	90	5	77	TINGKAYU	79	SP	II
					INTAN	88	C	II
					KALUMPANG	82	C	II
					PANG BURONG 1	65	SP	III
					PANG BURONG 2	69	SP	III
	UMAS-UMAS	93	1	79	UMAS-UMAS	79	SP	II
	BRANTIAN	94	1	80	BRANTIAN	80	SP	II
KALABAKAN	95	2	75	KALABAKAN	75	SP	III	

NOTE:

1. WQI BASED ON 6 MAJOR PARAMETERS: BOD, COD, SS, PH, DO, NH₃-N
2. RIVER WATER QUALITY STATUS: C : CLEAN, SP : SLIGHTLY POLLUTED, P : POLLUTED
3. RIVER CLASS BASED ON INWQS

Table 1.0 (c) Malaysia: Water Quality Status within Polluted River Basins, 2000

STATE	RIVER BASIN	CODE	NUMBERS OF STATIONS	OVERALL WQI	RIVER	WQI	RIVER STATUS	CLASS
KEDAH	MERBOK	04	10	59	BAKAR ARANG	52	P	IV
					BATU	26	P	V
					BONGKOK	69	SP	III
					BUKIT MERAH	59	P	III
					KOROK	38	P	IV
					MERBOK	74	SP	III
					PETANI	57	P	III
					TOK PAWANG	77	SP	II
					TUPAH	63	SP	III
					PULAU PINANG	JURU	06J	8
JURU	50	P	IV					
KILANG UBI	54	P	III					
PASIR	49	P	IV					
PINANG	06PP	7	41	RAMBAI		54	P	III
				AIR ITAM		52	P	IV
				DONDANG		43	P	IV
				JELUTONG		24	P	V
				KLUANG		45	P	IV
JEJAWI	07	5	54	PINANG		37	P	IV
				CEMPEDAK		41	P	IV
				JAWI		57	P	III
					JUNJONG	58	P	III
SELANGOR	BULOH KLANG	17	5	58	BULOH	58	P	III
		18	24	53	AMPANG	58	P	III
					BATU	62	SP	III
					DAMANSARA	56	P	III
					GOMBAK	75	SP	III
					JINJANG	48	P	IV
					KERAYONG	50	P	IV
					KEROH	50	P	IV
					KLANG	49	P	IV
					KUYOH	55	P	III
					PENCALA	31	P	V
JOHOR	AIR BALOI	27A	3	56	AIR BALOI	56	P	III
	SEGGET	28	5	51	SEGGET	51	P	IV
	KEMPAS	28E	2	52	KEMPAS	52	P	III
	DANGA	28F	2	59	DANGA	59	P	III
	TUKANG BATU	29B	5	44	BULUH	37	P	IV
					LATOH	57	P	III
					MASAI	58	P	III
					PEREMBI	43	P	IV
				TUKANG BATU	26	P	V	
TERENGGANU	LANDAS	42L	2	56	LANDAS	56	P	III

NOTE:

1. WQI BASED ON 6 MAJOR PARAMETERS: BOD, COD, SS, PH, DO, NH₃-N
2. RIVER WATER QUALITY STATUS: C : CLEAN, SP : SLIGHTLY POLLUTED, P : POLLUTED
3. RIVER CLASS BASED ON INWQS

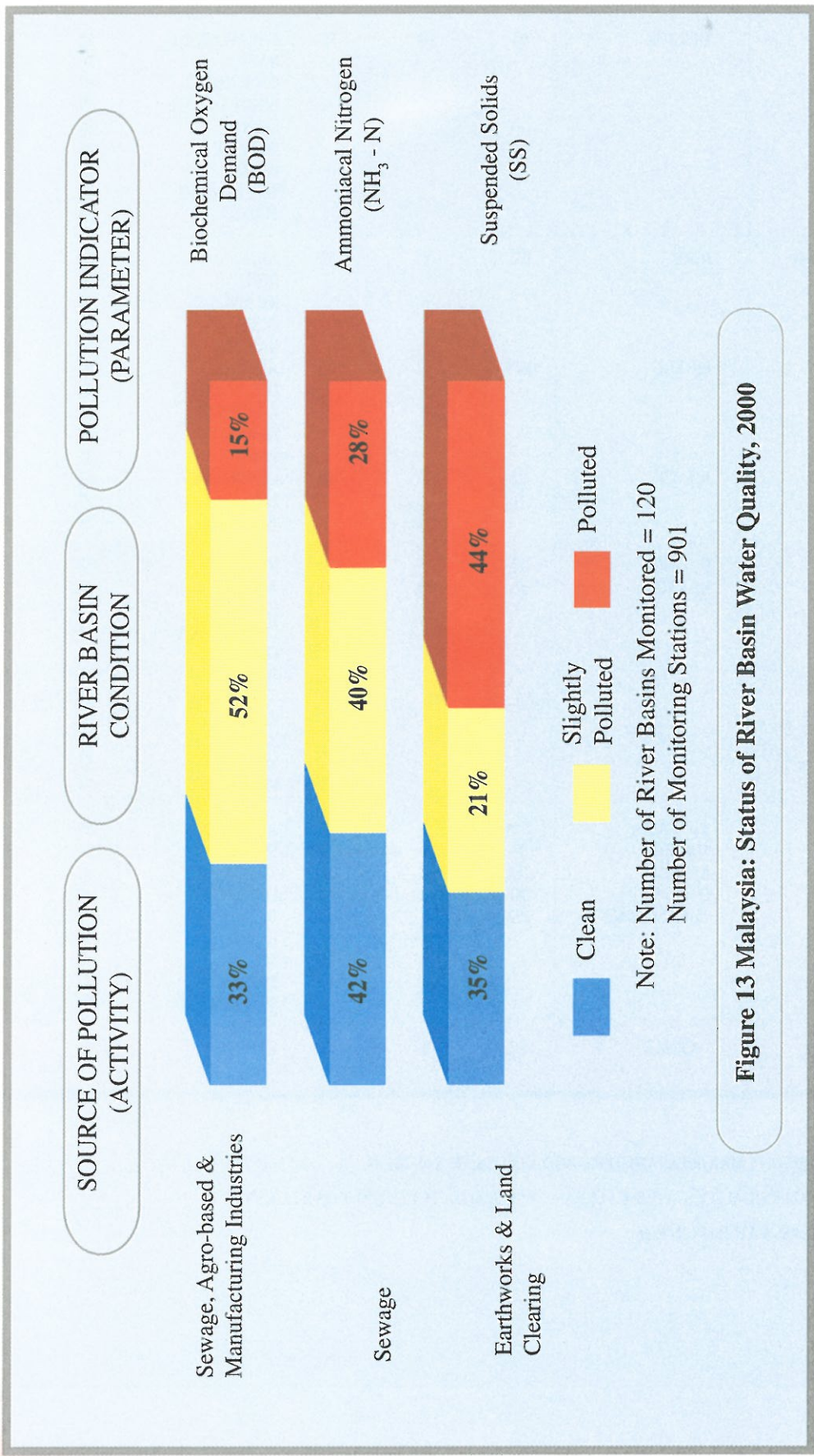
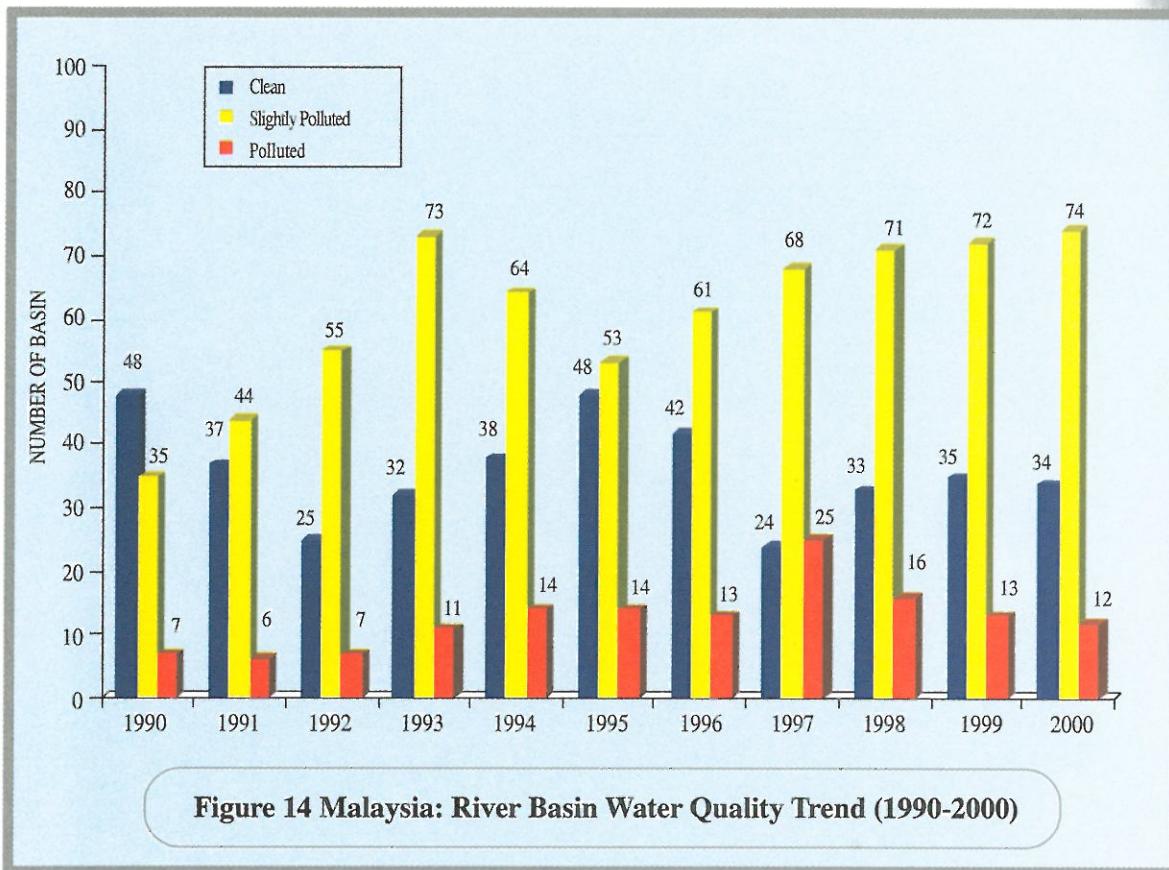


Figure 13 Malaysia: Status of River Basin Water Quality, 2000



sewage treatment facilities and the reduction in the total number of pig farms in Malaysia.

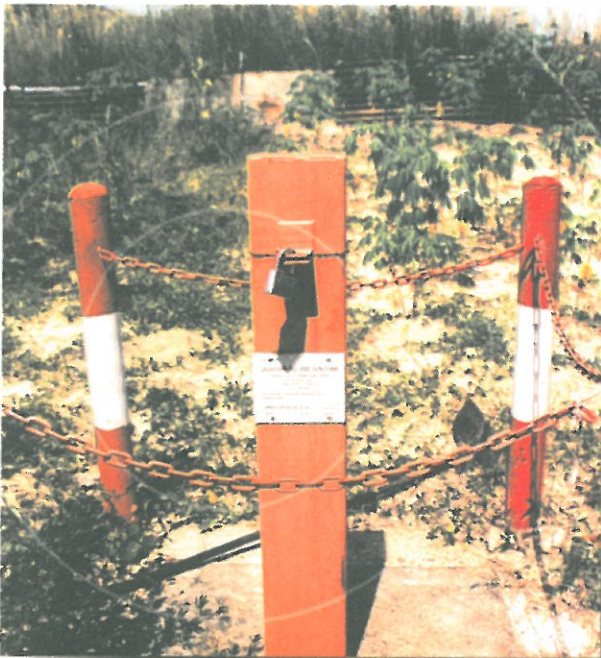
Analysis of heavy metals in 5,325 water samples revealed that almost all the samples complied with the Interim Water Quality Standards for arsenic (As), mercury (Hg), cadmium (Cd), chromium (Cr), lead (Pb) and zinc (Zn), except for iron (Fe) with 80% compliance.

Figure 14 shows the fluctuating river water quality trend between 1990 and 2000. Overall, the noticeable trend is the declining number of clean river basins while the number of slightly polluted river basins is on the increase. Thus in the Eighth Malaysia Plan (RM8), DOE has initiated an action programme for the improvement of water quality of selected rivers. The desired goals of the river water quality improvement programme are: clean and safe water supply, enhance fishing activities and increase use of rivers as amenities especially for recreation.



MALAYSIA

Environmental
Quality Report



GROUND WATER QUALITY



GROUNDWATER QUALITY

Introduction

Groundwater is an important potential source of water which has yet to be exploited to meet the increasing demand for domestic and industrial uses, particularly in areas facing surface water shortages. However human and other industrial activities are threatening its availability as an alternative source of water supply. **Map 2** shows the hydrogeological map of the Peninsula and their groundwater potential.

Groundwater Quality Monitoring

DOE started its groundwater monitoring programme in 1997. By the year 2000 there were 79 monitoring wells established at 48 sites in the Peninsula,

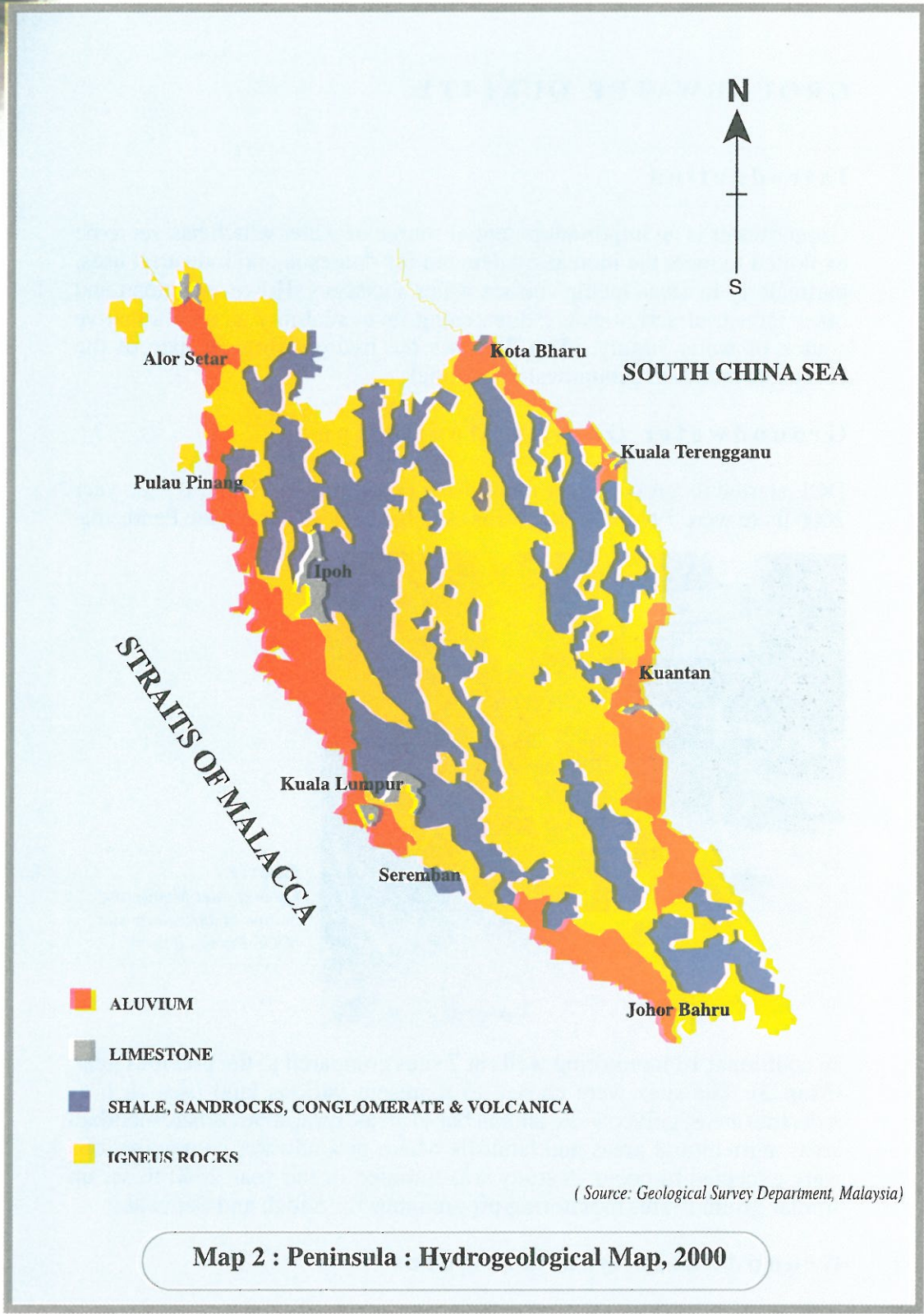


*Photo 12:
Groundwater Monitoring
Station at agriculture site.
(DOE Photo Library)*

an additional 18 monitoring wells at 7 sites compared to the previous year. (**Map 3**). The sites were chosen to represent various land uses such as industrial areas, golf courses, animal burial areas, rural areas, urban/suburban areas, agricultural areas and landfills where groundwater contaminations were expected to occur. A study was initiated in the year 2000 to set up similar groundwater monitoring programmes for Sabah and Sarawak.

Groundwater Quality Status

A total of 188 groundwater samples from 79 monitoring wells were collected and analysed in the year 2000. The parameters analysed were volatile organic compounds (VOC), pesticides, heavy metals, anions, bacteria, phenolic compounds, radioactivity, total hardness, total dissolved solids (TDS), pH, temperature, conductivity and dissolved oxygen. The National Guidelines for Raw Drinking Water Quality (1990) (**Table 2**) were used as the benchmark for determining the status of groundwater quality.



Map 2 : Peninsula : Hydrogeological Map, 2000



Map 3 Peninsula: Location of Monitoring Wells, 2000

Table 2 Malaysia: National Guidelines for Drinking Water Quality

CHEMICAL	SYMBOL	BENCHMARK
SULPHATE	SO ₄	400 mg/l
HARDNESS	CaCO ₃	500 mg/l
NITRATE	NO ₃	10 mg/l
COLIFORM	-	10 MPN
MANGANESE	Mn	0.2 mg/l
CHROMIUM	Cr	0.05 mg/l
ZINC	Zn	1.5 mg/l
ARSENIC	As	0.05 mg/l
SELENIUM	Se	0.01 mg/l
CHLORIDE	Cl	250 mg/l
PHENOLICS	-	0.002mg/l
TDS	-	1500mg/l
IRON	Fe	1mg/l
COPPER	Cu	1mg/l
LEAD	Pb	0.1mg/l
CADMIUM	Cd	0.005mg/l
MERCURY	hg	0.001mg/l

Source: Ministry of Health, Malaysia

Analysis showed that between 23% to 66% of samples taken in agricultural, urban/suburban, industrial areas, landfills and golf courses recorded iron (Fe) levels exceeding the benchmark, attributed to naturally-occurring ferum constituent in the soil (**Figure 15**).

Phenol levels exceeded the benchmark values for agricultural areas (19%), industrial areas (39%) and landfill sites (31%); while in the case of arsenic(As), the percentage exceeding benchmark values for agricultural, industrial and landfill sites were 8%, 20% and 33% respectively. Samples taken from industrial sites were found to have more parameters exceeding the benchmark levels than those taken from other sites (**Figure 16**).

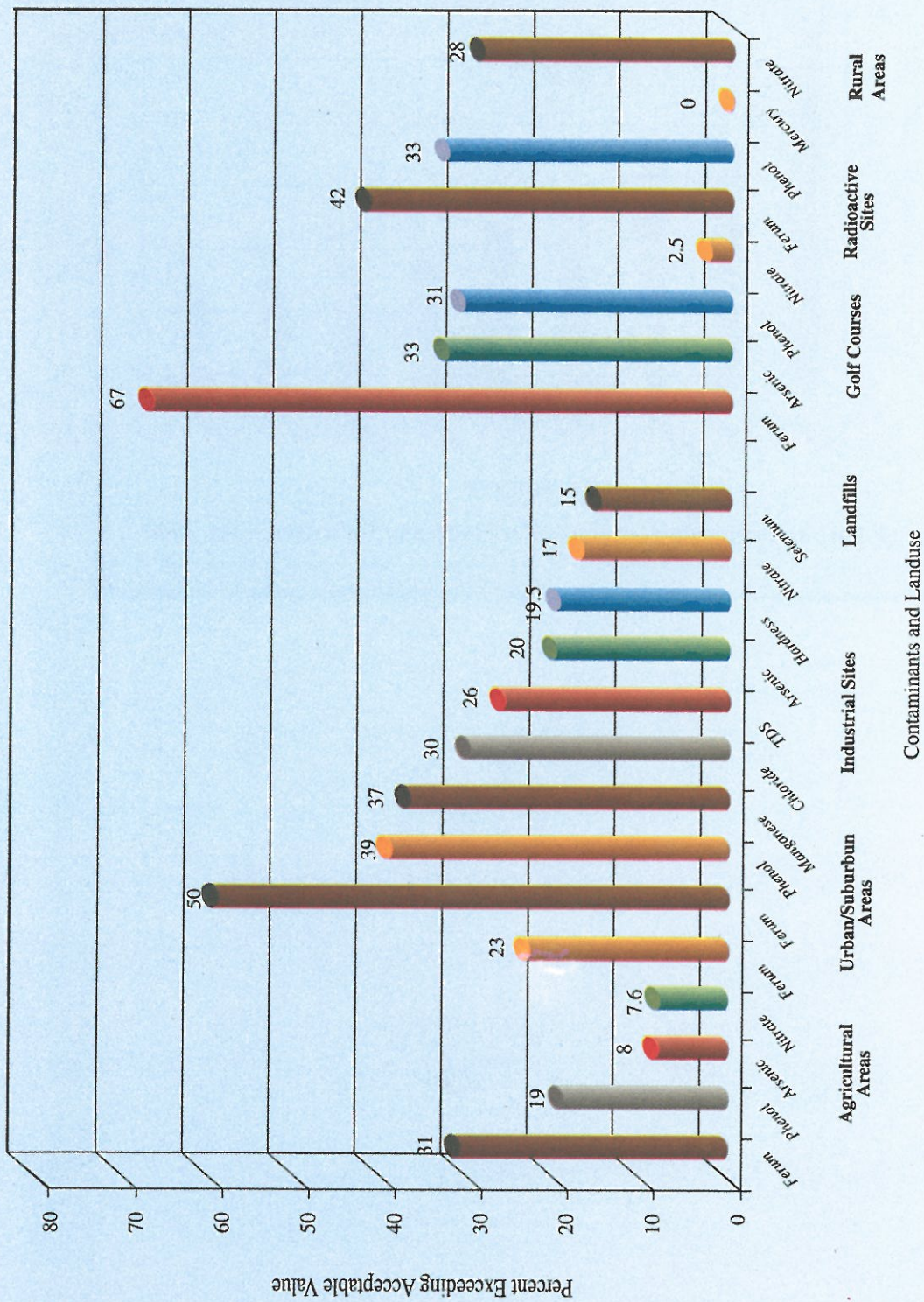


Figure 15 Peninsula : Percentage of Non-Compliance of Selected Contaminants by Landuse, 2000

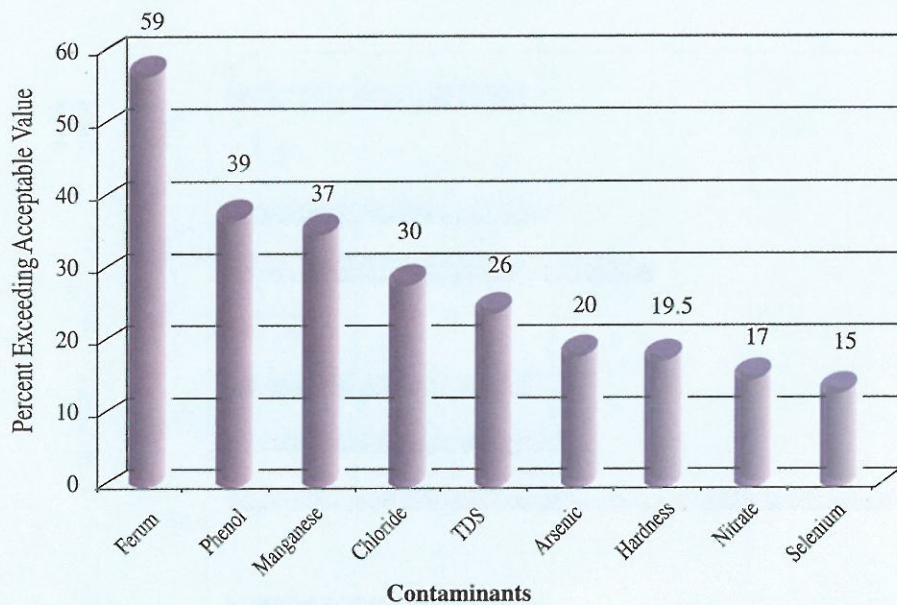


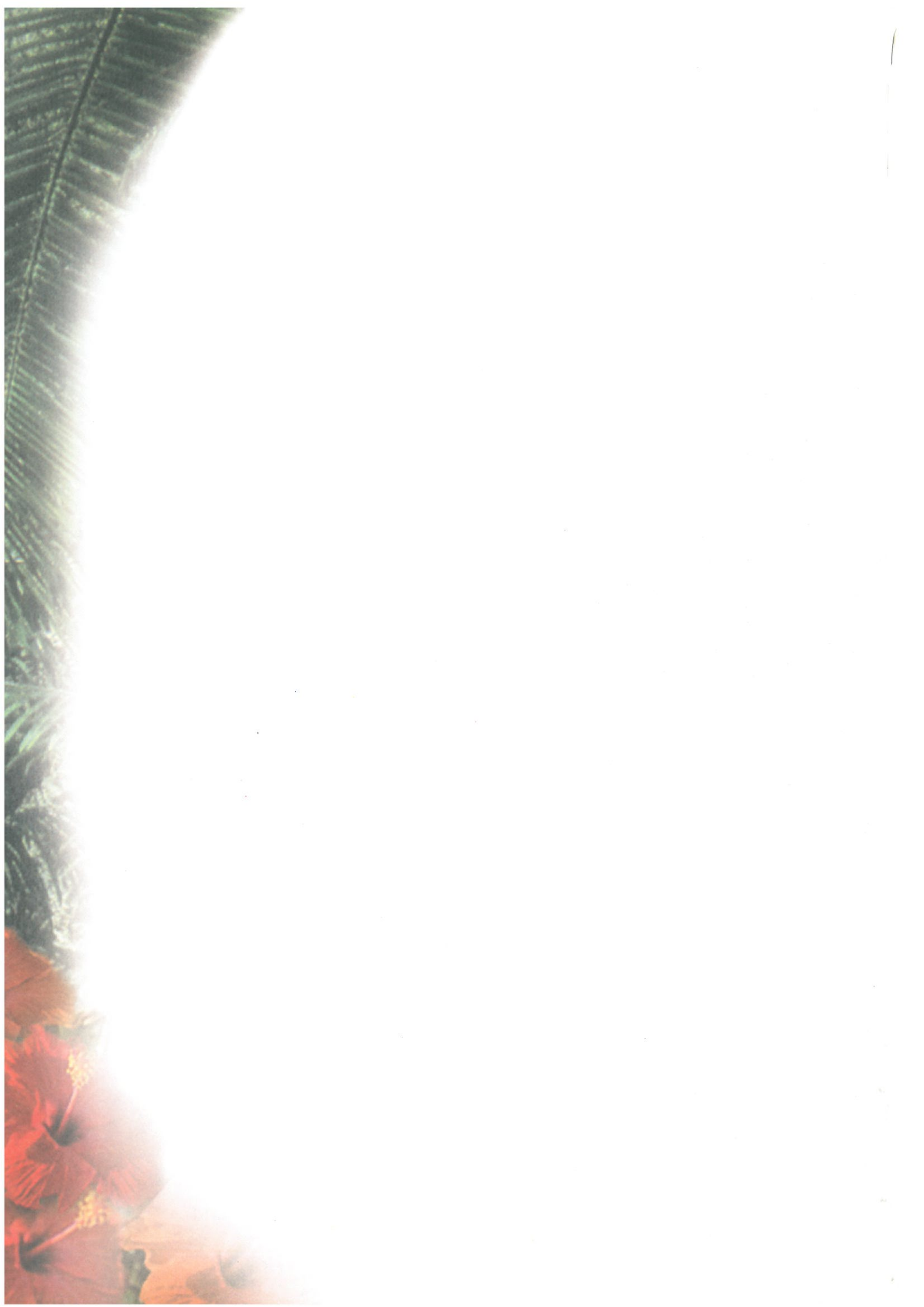
Figure 16 Peninsula : Groundwater Quality at Industrial Sites, 2000

MALAYSIA

Environmental
Quality Report



MARINE ENVIRONMENTAL QUALITY



MARINE ENVIRONMENTAL QUALITY

Introduction

The Department of Environment (DOE) has been regularly monitoring marine water quality in the Peninsula since 1978 and Sabah and Sarawak since 1985. Presently there are 213 monitoring stations throughout the country. The selection of these stations are based on several criteria, principally their beneficial uses such as for recreation. Apart from the national coastal water monitoring programme, DOE has also been monitoring the marine water quality of 71 islands in the country since July 1998. These islands are categorised as Development Islands, Resort Islands, Marine Park Islands and Protected Islands (**Table 3**).



Photo 13:
Recreational beach
(DOE Photo Library)

Marine water quality assessment is based on physical, chemical and biological characteristics. Two types of measurements are carried out i.e. *in situ* and laboratory analysis. *In situ* measurements include parameters such as turbidity, salinity, temperature, pH, dissolved oxygen and electrical conductivity, while laboratory analysis include total suspended solids, oil and grease, total organic carbon, nitrate, copper, cadmium, chromium, lead, arsenic, mercury and *Escherichia coli*.

The bench marking for marine water quality is based on the Interim Marine Water Quality Standards (MIS)(**Table 4**).

Table 3 Department of Environment: Island Marine Water Quality Monitoring, 2000

NO	STATE	ISLAND	CATEGORY	NO. OF STATIONS
1.	KEDAH	Langkawi	Development	4
		Singa Besar	Resort	1
		Dayang Bunting	Resort	1
		Payar	Marine Park	1
		Kaca	Marine Park	1
		Lembu	Marine Park	1
		Segantang	Marine Park	1
2.	PERAK	Pangkor	Resort	2
		Pangkor Laut	Resort	1
		Sembilan	Resort	1
3.	PULAU PINANG	Pulau Pinang	Development	4
		Aman	Resort	1
		Jerejak	Resort	1
		Gedong	Resort	1
		Kendi	Resort	1
		Rimau	Resort	1
4.	SELANGOR	Ketam	Resort	1
		Angsa	Resort	1
		Lumut	Resort	1
5.	MELAKA	Besar	Resort	1
		Upeh	Resort	1
6.	PAHANG	Tioman	Marine Park	2
		Tulai	Marine Park	1
		Chebeh	Marine Park	1
		Labas	Marine Park	1
		Sepui	Marine Park	1
		Seri Bulat	Marine Park	1
		Sembilan	Marine Park	1
		Tokong Berhala	Marine Park	1
		But	Marine Park	1
7.	JOHOR	Setindan	Resort	1
		Harimau	Marine Park	1
		Mensirip	Marine Park	1
		Gual	Marine Park	1
		Rawa	Marine Park	1
		Pemanggil	Marine Park	1
		Hujung	Marine Park	1
		Tengah	Marine Park	1
		Hujung Tengah	Resort	1
		Dayang	Resort	1
		Aur	Marine Park	1
		Besar	Marine Park	1
		Tinggi	Marine Park	1
		Mentinggi	Marine Park	1
		Sibu	Marine Park	1
Sibu Hujung	Marine Park	1		

NO	STATE	ISLAND	CATEGORY	NO. OF STATIONS
8.	TERENGGANU	Gumia	Resort	1
		Kapas	Marine Park	1
		Tenggol	Protected	1
		Nyireh	Protected	1
		Bidong	Resort	1
		Duyong	Resort	1
		Susu Dara	Marine Park	1
		Perhentian Besar	Marine Park	2
		Redang	Marine Park	2
		Perhentian Kecil	Marine Park	1
		Lang Tengah	Marine Park	1
		Pinang	Marine Park	1
		Ekor Tebu	Marine Park	1
		Lima	Marine Park	1
9.	SABAH (Labuan)	Gaya	Resort	1
		Layang-Layang	Resort	1
		Ligitan	Resort	1
		Sipadan	Resort	2
		Labuan	Development	4
		Kuraman	Marine Park	1
		Rusukan Kecil	Marine Park	1
		Rusukan Besar	Marine Park	1
10.	SARAWAK	Satang Besar	Protected	1
		Talang-Talang Kecil	Protected	1
		Talang-Talang Besar	Protected	1
TOTAL		71 Islands		85

	Category	No. of Islands	No. of Stations
i.	Resort Island	25	27
ii.	Marine Park Island	38	41
iii.	Protected Island	5	5
iv.	Development Island	3	12

Table 4 Malaysia: Interim Marine Water Quality Standard

PARAMETERS		UNIT	INTERIM STANDARDS
Escherichia coli	E-coli	MPN /100 ml	100
Oil & Grease	O & G	mg/l	0
Total Suspended Solids	TSS	mg/l	50
Arsenic	As	mg/l	0.1
Cadmium	Cd	mg/l	0.1
Chromium (total)	Cr	mg/l	0.5
Copper	Cu	mg/l	0.1
Lead	Pb	mg/l	0.1
Mercury	Hg	mg/l	0.001
Nickel	Ni	mg/l	0.1

Marine Water Quality Status

In the year 2000, a total of 993 samples were collected from 213 marine monitoring stations. As in previous years, the main contaminants of the coastal waters in all States were total suspended solids (TSS), oil and grease (O&G) and *Escherichia coli* (*E. coli*) (Figure 17).

Of the 993 samples analyzed, 74 % of samples for total suspended solids, 53 % for oil and grease and 47 % for *E. coli* exceeded the Interim Marine Water Quality Standards (Table 4).

Suspended solids levels were highest in the coastal waters off Pahang, Kedah, Perlis, Perak, Negeri Sembilan and Selangor. All samples collected exceeded the MIS of 50 mg/l for total suspended solids (TSS).

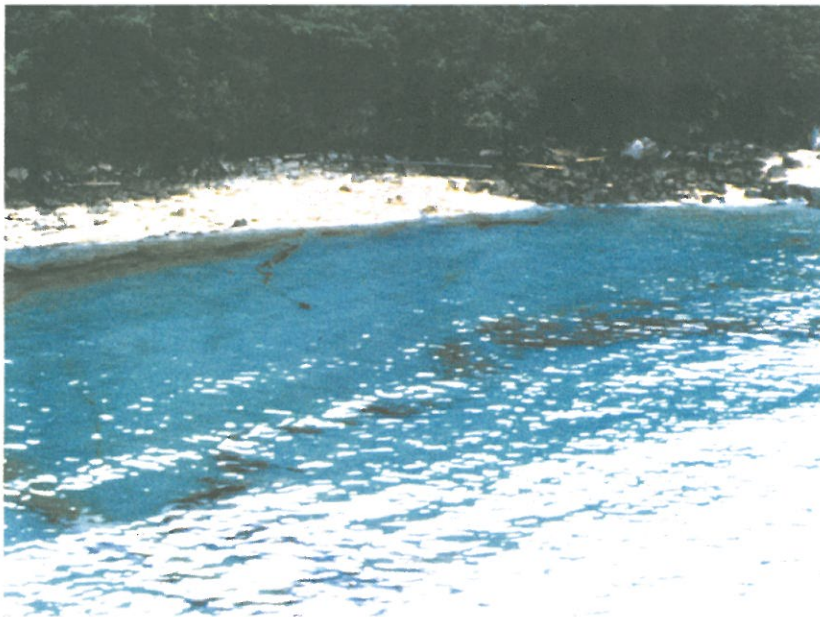


Photo 14:
Beach affected by oil pollution
(DOE Photo Library)

The estuaries of Kuala Sg. Kurau, Kuala Sg. Tg. Piandang and Kuala Sg. Manjung in Perak; Kuala Sg. Linggi and Kuala Sg. Lukut in Negri Sembilan; and Kuala Sg. Sebatu, Kuala Sg. Merlimau and Kuala Sg. Melaka in Malacca; and Kuala Sg. Bernam in Selangor were found to have substantially high levels of suspended solids. Activities such as coastal reclamation, road construction and intensive clearing of land for agriculture, tourism development, construction of hotels and resorts along the coast without adequate control and protection measures resulted in erosion and sedimentation of coastal waters. Silt and sediment carried down by rivers had been identified as significant contributors of high levels of TSS. High TSS in coastal waters could lead to fishery loss, decrease recreational values and impact on mangrove and coral ecosystems.

Oil and grease pollution remained a significant problem particularly in the coastal waters off Kedah/Perlis (100% exceeding MIS), Langkawi(100%

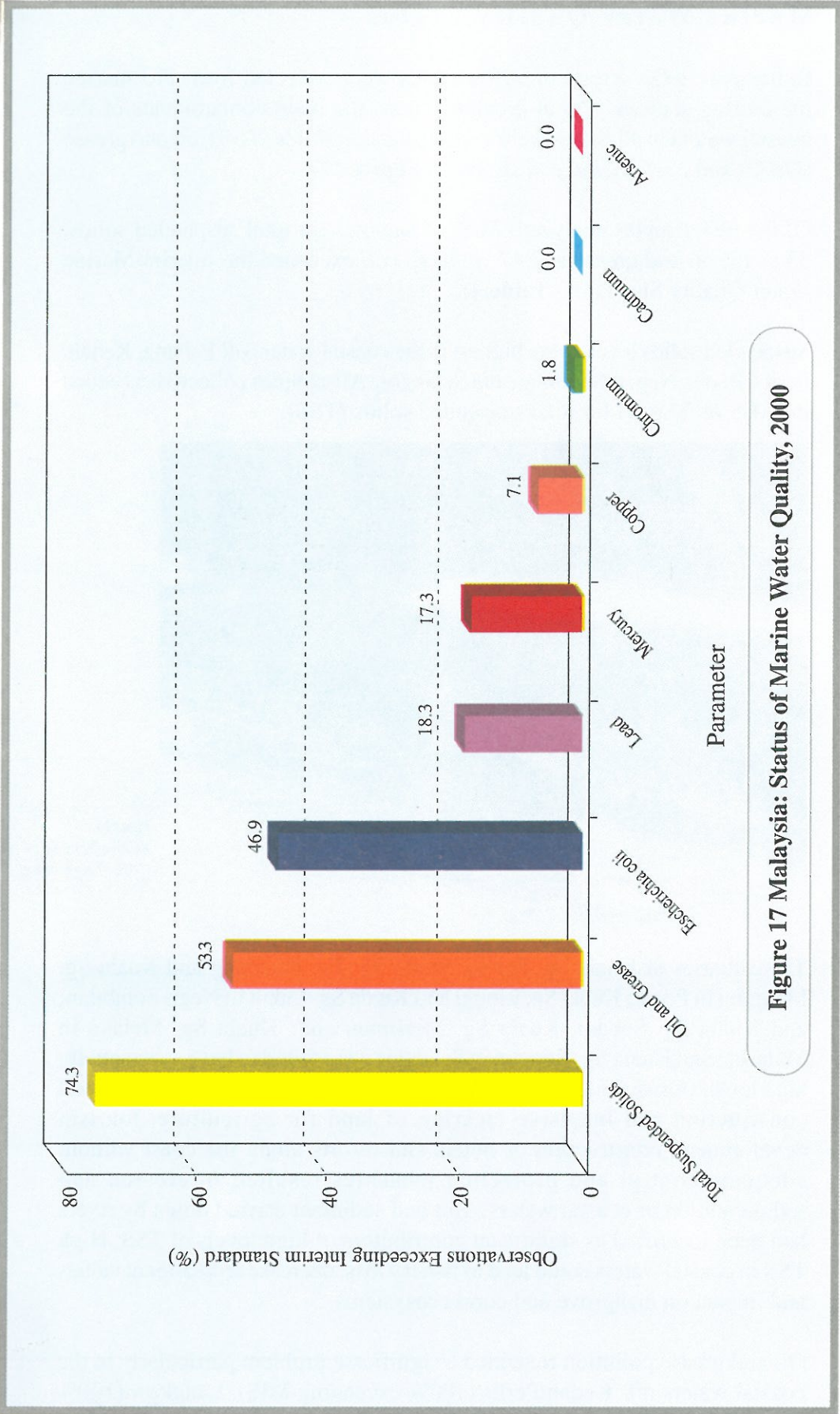


Figure 17 Malaysia: Status of Marine Water Quality, 2000

Table 5 Malaysia: Status Of Marine Water Quality, 2000

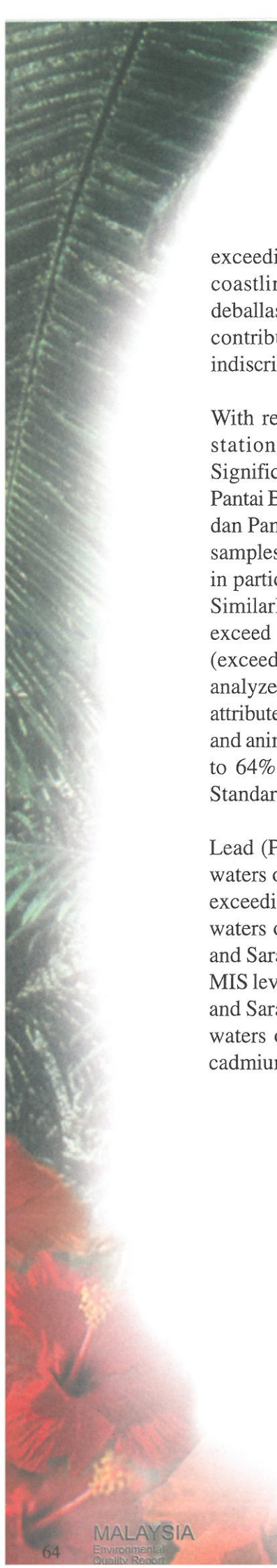
State	No. of Station	No. of Sample	Total Suspended Solids	Parameter Exceeding Interim Standard (%)										
				Oil and Grease	<i>Escherichia coli</i>	Lead	Mercury	Copper	Chromium	Cadmium	Arsenic			
Pahang	14	35	100	0	10	6	NA	0	0	NA	0	0	NA	
Johor	40	222	14	4	72	0	4	0	0	0	0	0	0	
Kedah	3	12	100	100	NA	17	58	0	0	0	0	0	0	
Perlis	2	6	100	100	NA	0	50	0	0	0	0	0	0	
Kelantan	10	45	65	53	33	73	0	0	0	0	0	0	0	
Melaka	10	55	96	50	51	0	0	0	0	0	0	0	0	
Pulau Pinang	23	180	79	98	92	22	34	38	0	0	0	0	0	
Perak	13	50	100	50	64	39	0	0	24	0	0	0	0	
Sabah	26	84	1	1	2	10	NA	0	0	0	0	0	NA	
Sarawak	18	106	41	48	30	26	0	8	0	0	0	0	0	
Terengganu	16	64	47	73	58	61	2	0	0	0	0	0	0	
N. Sembilan	13	50	100	41	74	2	8	0	0	0	0	0	0	
Selangor	14	48	100	28	52	0	19	0	0	0	0	0	0	
P.Langkawi	11	36	97	100	25	0	33	53	0	0	0	0	0	
Total	213	993	74.3	53.3	46.9	18.3	17.3	7.1	2	0	0	0	0	
Average (%)														

Note:

NA - Not Available

Interim Marine Water Quality Standards

TSS	O & G	E.coli	Pb	Hg	Cu	Cr	Cd	As
(50 mg/l)	(0 mg/l)	(100MPN/100ml)	(0.1 mg/l)	(0.001 mg/l)	(0.1 mg/l)	(0.5 mg/l)	(0.1 mg/l)	(0.1 mg/l)



exceeding MIS) and Penang(100% exceeding MIS), while the Pahang coastline was free of oil pollution. Discharges from vessels such as deballasting, tank cleaning, bilges and bunkering were the most significant contributors to the high levels of oil and grease besides leakages and indiscriminate disposal of used engine oil from ferries and boats.

With respect to *E.coli* contamination, 92% of the 180 samples from 23 stations in Penang waters exceeded the MIS of 100MPN/100ml. Significantly high levels (exceeding 5000 MPN/100ml) were detected at Pantai Bayan Lepas, Perai, Gertak Sanggul, Kuala Sg. Juru, Kuala Sg. Pinang dan Pantai Teluk Tempoyak in Penang. In Negeri Sembilan, 74% of the 50 samples collected from 13 stations were found to have exceeded the MIS, in particular at Pantai Bagan Pinang, Batu 7 and Batu 10 in Port Dickson. Similarly in Johor, 72% of the 222 samples from 40 stations were found to exceed the MIS particularly at Kuala Sg. Mersing and Kuala Sg. Segget (exceeding 1000 MPN/100ml). Comparatively only 2% of the samples analyzed for Sabah waters exceeded the MIS. The presence of *E.coli* was attributed to the discharge of partially treated and untreated domestic sewage and animal wastes. As for the other stations, between 25% (Pulau Langkawi) to 64% (Perak) of stations exceeded the Interim Marine Water Quality Standard for *E.coli*.

Lead (Pb) exceeding the MIS level of 0.1 mg/l was found in the coastal waters off Kelantan (73 %), Terengganu (61%) and Perak (39%); mercury exceeding the MIS level of 0.001 mg/l was recorded highest in the coastal waters off Kedah (58%) and Perlis (50%) while Kelantan, Melaka, Perak and Sarawak were free from mercury contamination; copper exceeding the MIS level of 0.1 mg/l was only recorded off Langkawi(55%), Penang(38%) and Sarawak(80%); twenty four percent (24%) of samples from the coastal waters off Perak exceeded the MIS for total chromium (0.5 mg/l). Only cadmium and arsenic levels remained within the MIS for all States.

Discharges associated with partially treated and untreated industrial wastes and from other land-based sources influenced the level of heavy metal contaminants in the marine environment. In summary, the main pollutants of the coastal environment in order of significance were total suspended solids, oil and grease and *E.coli*, lead, mercury, copper and chromium.

Island Marine Water Quality Status

In the year 2000, 728 samples were collected from 85 monitoring stations around 71 islands all over Malaysia. High levels of *E. coli* contamination were found in 17% of samples collected around Penang (Development



Photo 15:
Marine Water Quality Sampling
(DOE Photo Library)

Island). Intensive development activities and husbandry wastes were the contributing factors for the high levels of *E.coli*. Inefficient sewage treatment facilities had compounded the problem. However, Resort Islands off Penang, Terengganu and Selangor, a Protected Island off Sarawak and two Marine Park Islands off Johore recorded a much lower incidence of *E. coli* contamination (9.1%, 4.3% and 0.9% respectively)(**Figure 18**)

Oil and grease contamination with levels exceeding the MIS were recorded in 14% of samples from Development Islands (Pulau Langkawi, Pulau Pinang and Pulau Labuan); 4% of samples from Protected Islands (Pulau Talang-Talang Besar off Labuan and Pulau Tenggol off Terengganu); 3.6 % of samples from the Resort Islands (Pulau Sipadan and Pulau Mabul off

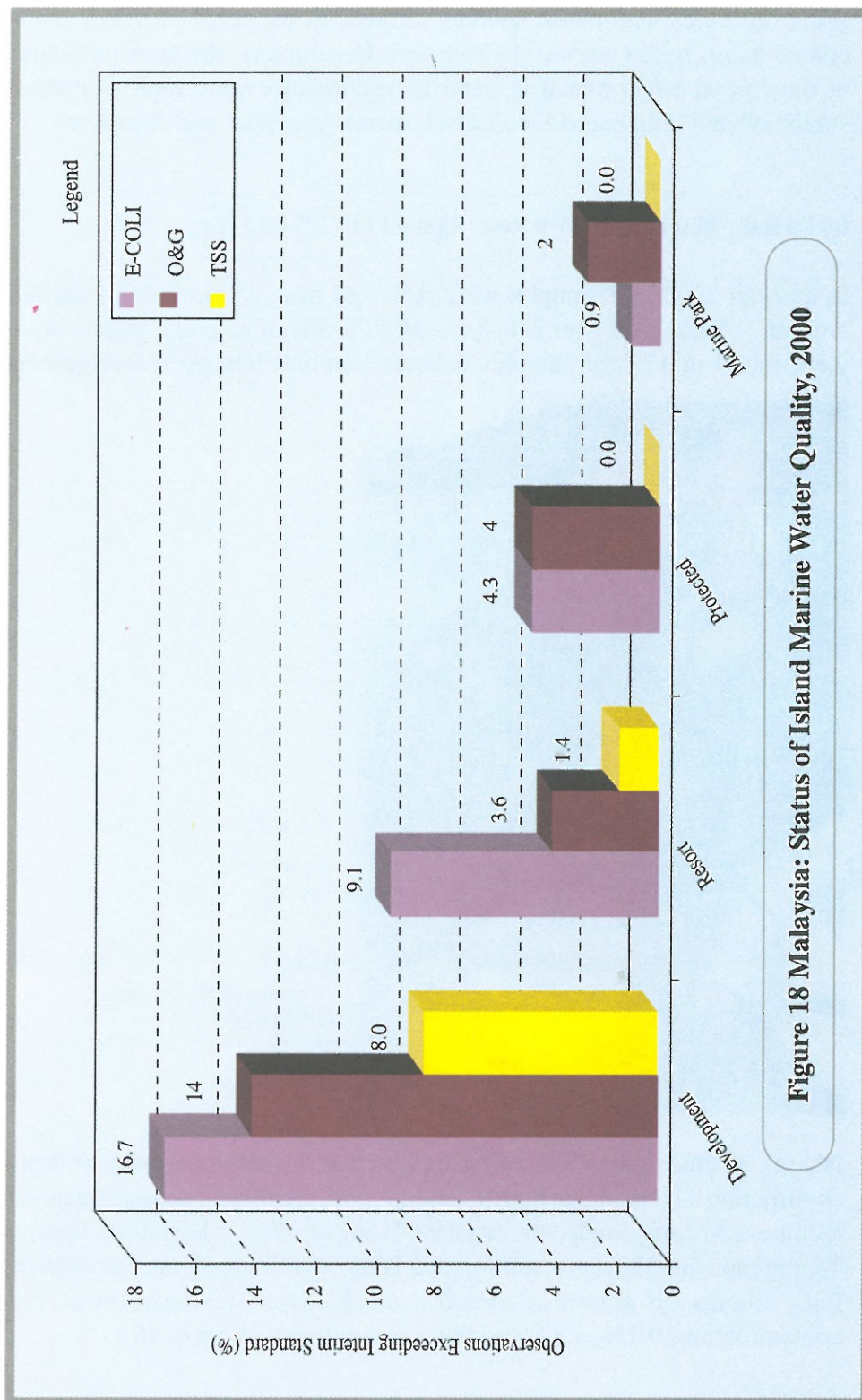


Figure 18 Malaysia: Status of Island Marine Water Quality, 2000

Sabah, Pulau Ketam off Selangor and Pulau Dayang Bunting off Kedah); and 2% of samples from Marine Park Islands (Pulau Susu Dara off Terengganu, Pulau Segantang and Pulau Lembu off Kedah and Pulau Tioman, But, Cebeh and Sembilang off Pahang). All samples analyzed showed concentrations of 2 mg/l of oil and grease above the MIS (0 mg/l). Boating activities around jetties for tourism and fisheries were believed to be the principal causes of oil and grease pollution.

The levels of total suspended solids around Protected and Marine Park Islands were found to be within the MIS. Similarly, the heavy metal levels at all islands were within the MIS.

Beach Oil Pollution (Tarballs)

Several beaches in Terengganu, Melaka and Kedah (Langkawi) were found to be affected by oil pollution in the form of tarballs (**Table 6**) which consisted essentially of weathered oily wastes discharged from passing vessels and fishing boats.

Tarballs were also recorded on the Teluk Dalam beaches of Pulau Perhentian Besar in Terengganu and at Pulau Layang-Layang in Sabah. Of the 143 beaches monitored for beach tar, 7% were affected by beach tarballs.

Table 6 Malaysia: Beaches affected by Tarball, 2000

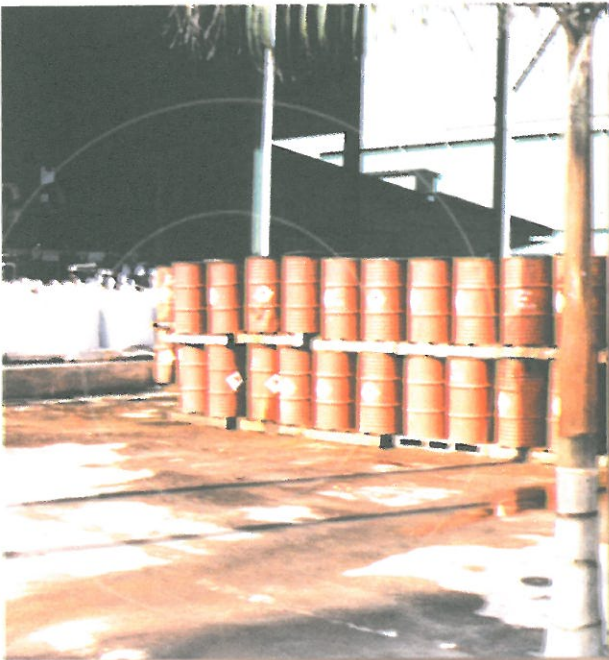
State	Station	Station No.	Sampling Date	Tar Ball g/m strip
Terengganu	Rantau Abang Beach	4833917	24-Jan-00	24.70
	Selatan Tioxide Final Discharge	4234952	25-Jan-00	18.40
	Pantai Batu Buruk	5331935	26-Jan-00	2.00
P.Langkawi	Pantai Teluk Burau	6396923	22-Aug-00	90.00
	Pantai Tanjung Rhu	6498916	22-Aug-00	1110.00
Melaka	Pantai Rombang	2221906	8-Aug-00	170.00
	Pantai Kundur	2221908	8-Aug-00	370.00
Johor	Pantai Tanjung Leman	2140964	1-Jan-00	37.5
	Pantai Tanjung Leman	2140964	23-Mar-00	657.0
	Pantai Tanjung Leman	2140964	25-May-00	238.0
	Pantai Tanjung Leman	2140964	6-Jul-00	137.0
	Pantai Tanjung Leman	2140964	24-Oct-00	47.0
	Pantai Tanjung Leman	2140964	21-Dec-00	113.0
	Pantai Telok Mahkota, Kota Tinggi	1841911	2-Feb-00	18.2
	Pantai Sri Pantai, Mersing	2339960	2-Feb-00	78.5
	Pantai Sri Pantai, Mersing	2339960	11-Apr-00	57.0
	Pantai Sri Pantai, Mersing	2339960	21-Jun-00	348.0
	Pantai Sri Pantai, Mersing	2339960	18-Sep-00	38.0
	Pantai Sri Pantai, Mersing	2339960	6-Nov-00	97.0
	Pantai Telok Gorek, Mersing	2538958	2-Feb-00	18.0
	Pantai Telok Gorek, Mersing	2538958	11-Apr-00	37.0
	Pantai Telok Gorek, Mersing	2538958	18-Sep-00	27.0
	Pantai Telok Gorek, Mersing	2538958	6-Nov-00	133.0
	Pantai Air Papan, Mersing	2538959	2-Feb-01	349.0
	Pantai Air Papan, Mersing	2538959	11-Apr-01	28.0
	Pantai Air Papan, Mersing	2538959	22-Jun-01	382.0
	Pantai Air Papan, Mersing	2538959	18-Sep-01	23.0
	Pantai Air Papan, Mersing	2538959	6-Nov-01	85.0
	Pantai Tanjung Setapa, Kota Tinggi	1341961	21-Feb-01	67.0
	Pantai Tanjung Setapa, Kota Tinggi	1341961	13-Mar-01	433.0
	Pantai Tanjung Setapa, Kota Tinggi	1341961	11-May-01	17.0
	Pantai Desaru, Kota Tinggi	1542914	28-Feb-01	637.0
	Pantai Desaru, Kota Tinggi	1542914	13-Mar-01	21.0
	Pantai Desaru, Kota Tinggi	1542914	13-Jun-01	207.0
Pantai Desaru, Kota Tinggi	1542914	7-Aug-01	47.0	
Pantai Desaru, Kota Tinggi	1542914	5-Oct-01	74.0	
Pantai Desaru, Kota Tinggi	1542914	4-Dec-01	23.0	

State	Station	Station No.	Sampling Date g/m strip	Tar Ball
Terengganu	Island			
	Teluk Dalam (Pulau Perhentian Besar)		9-Feb-00	50.0
Sabah	Layang - Layang		17-Apr-00	1.40
	Layang - Layang		5-Oct-00	3.79



MALAYSIA

Environmental
Quality Report



POLLUTION SOURCES INVENTORY

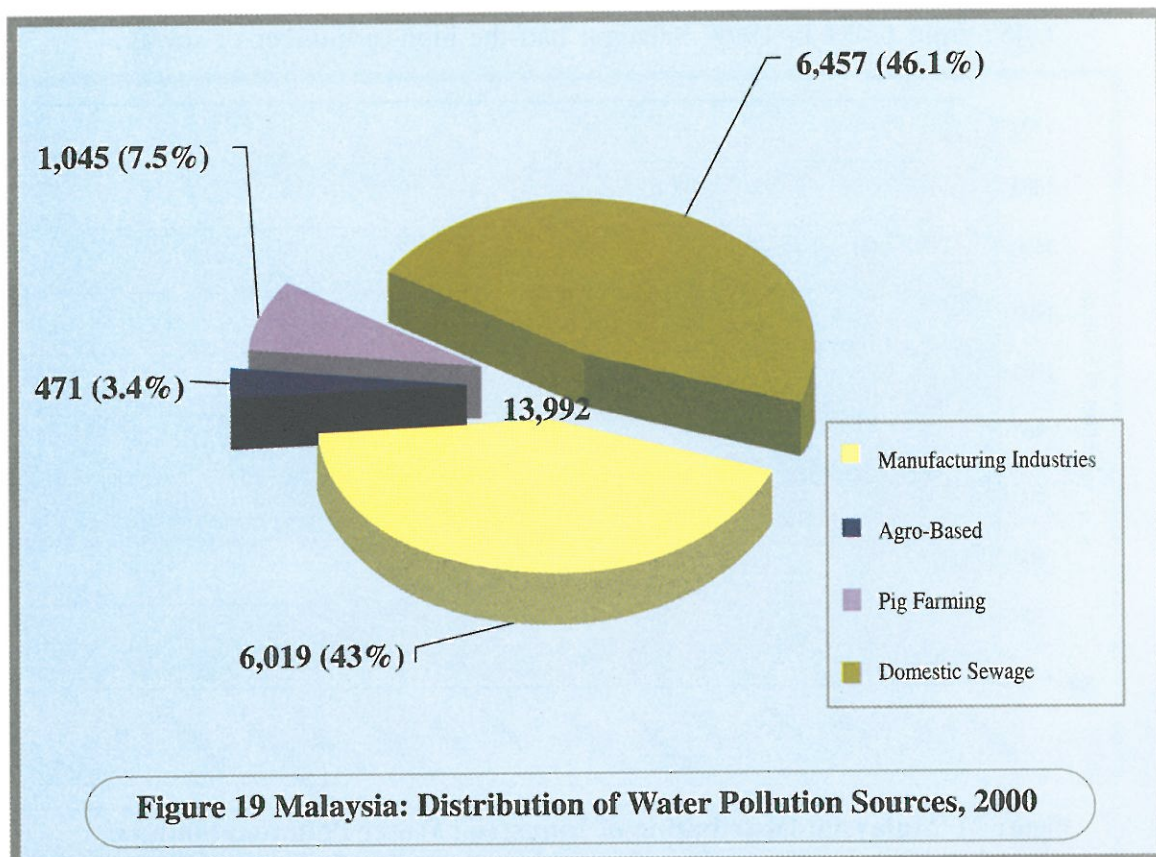


POLLUTION SOURCES INVENTORY

Water Pollution Sources

The estimated number of effluent-related sources for the year 2000 was 13,992 comprising mainly of agro-based industries, manufacturing industries, pig farms and sewage treatment plants (**Figure 19**). Of this number 6,457 sources (46.1%) were domestic sewage facilities, followed by the manufacturing sector (6,019, 43%), pig farms (1,045, 7.5%) and agro-based industries (471, 3.4%). The pollution load contributed by these four sectors significantly affect the river water quality in Malaysia.

Based on the source inventory compiled in 2000, a total of 6,490 agro-based and manufacturing industries were identified (**Figure 20**). Out of the 16 types of manufacturing industries, the main polluting sources were food and beverage industry with 1,538 sources constituting 23.7% of the total number, followed by electric and electronic industry (738, 11.4%), chemical-based industry (729, 11.2%), paper (571, 8.8%), textile (481, 7.4%), metal finishing & electroplating (343, 5.3%), crude palm oil mills (343, 5.3%) and raw natural rubber factories (128, 2%). Selangor, Johor and Perak made up more than 59% of the total number of sources (**Figure 21**).



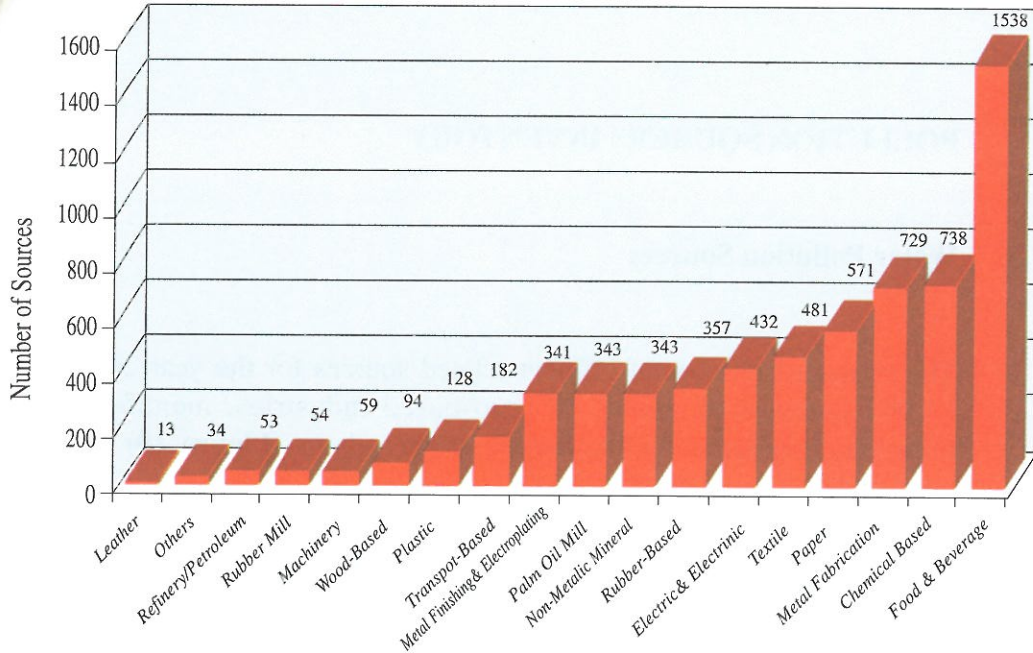


Figure 20 Malaysia: Industrial Water Pollution Sources (Agro- Based and Manufacturing Industries), 2000

In 2000, the total standing pig population (SPP) in Peninsula had increased from 1.37 million in 1999 to 1.39 million and the number of farms decreased from 819 in 1999 to 783. These pig farms were concentrated mainly in 3 States, Pulau Pinang (300, 28.7%), Perak (188, 18%) and Selangor (130, 12.4%).

The number of sewage treatment plants identified in 2000 had increased to 6,457 from 6,081 in 1999. Selangor had the highest number of sewage

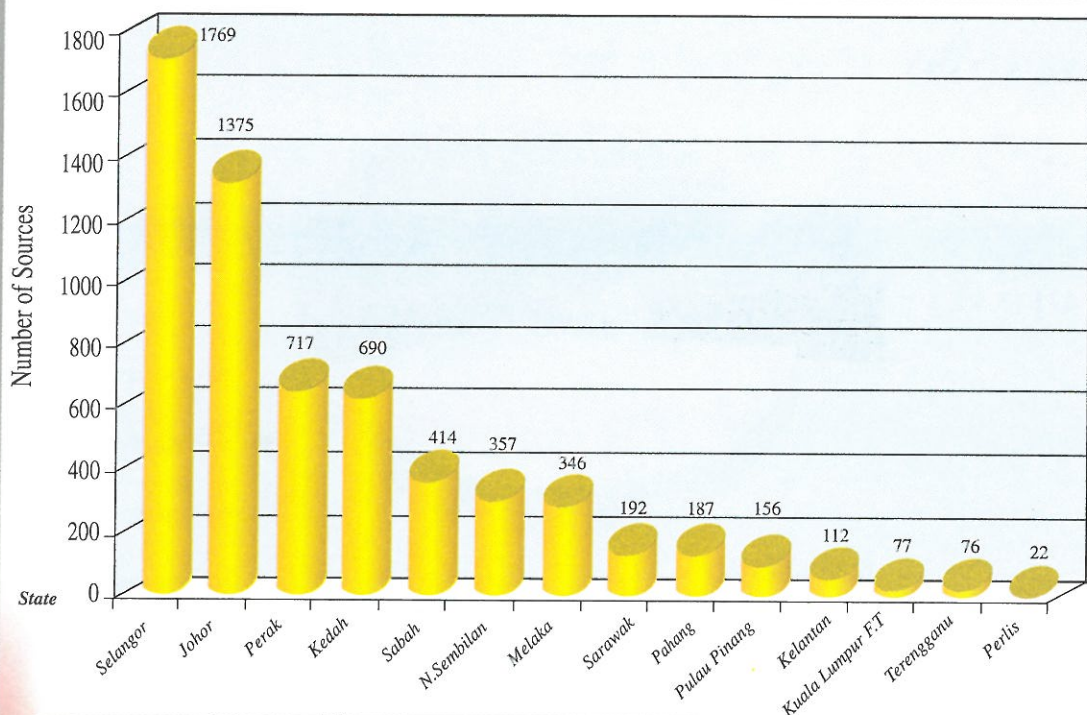


Figure 21 Malaysia: Distribution of Industrial Water Pollution Sources (Agro- Based and Manufacturing Industries) By State, 2000

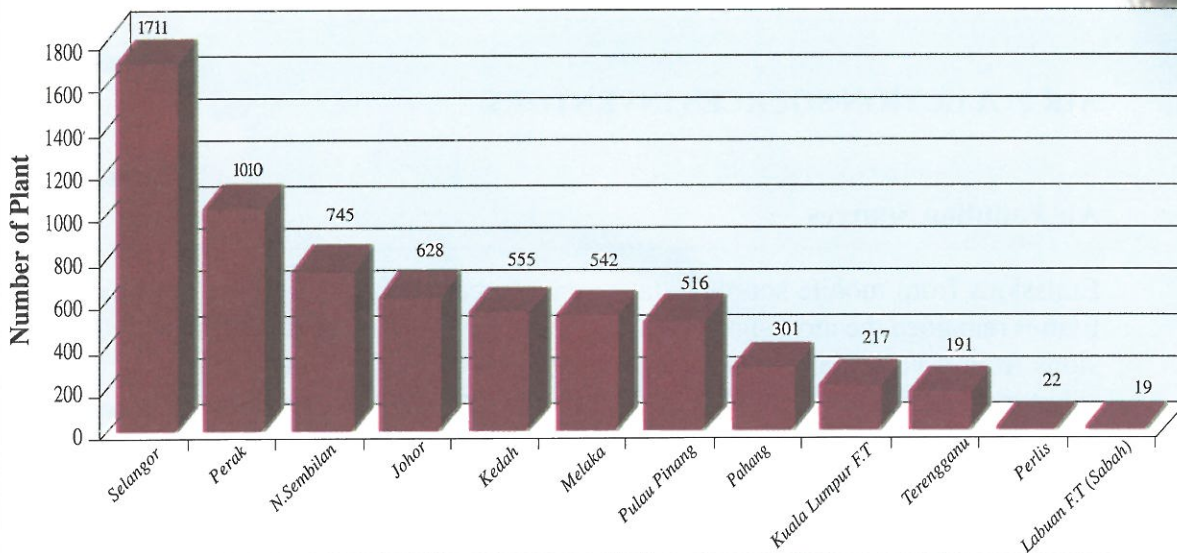


Figure 22 Malaysia: Distribution of Sewage Treatment Plants By State, 2000

treatment plants (1,711, 26.5%), followed by Perak (1,010, 15.6%), Negeri Sembilan (745, 11.5%) and Johor (628, 9.7%) (Figure 22).

BOD Pollution Load

Sewage discharges (treated, partially treated, untreated) remained the largest contributors of organic pollution load with an estimated biochemical oxygen demand (BOD) load of 1,023 tonnes per day, followed by pig farming activities (196 tonnes/day), manufacturing industry (19 tonnes/day) and licensed agro-based industry (14 tonnes/day). Figure 23 shows the organic pollution load by sectors between 1996 to 2000.

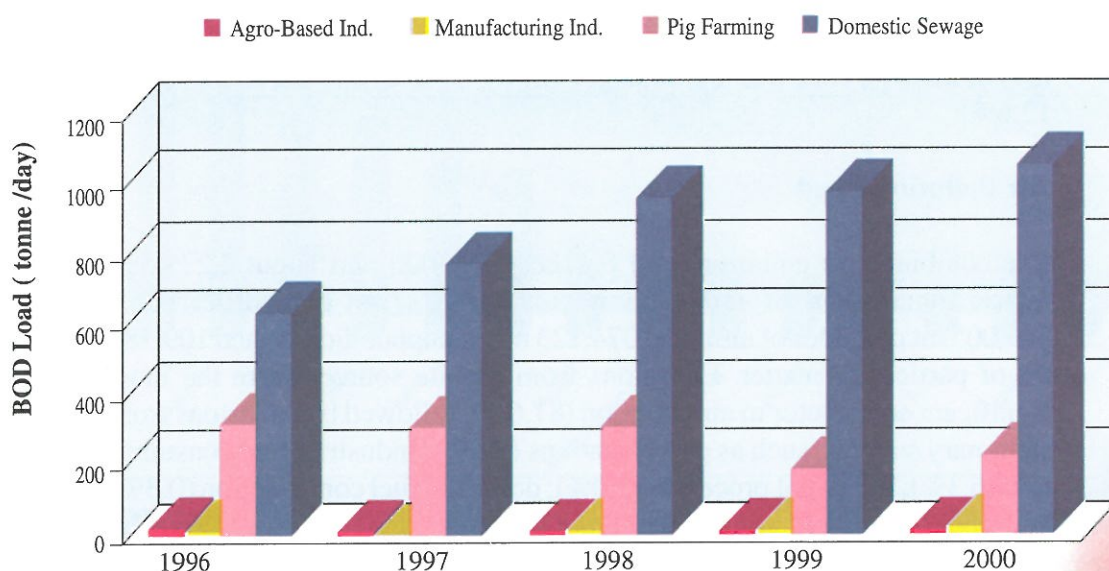
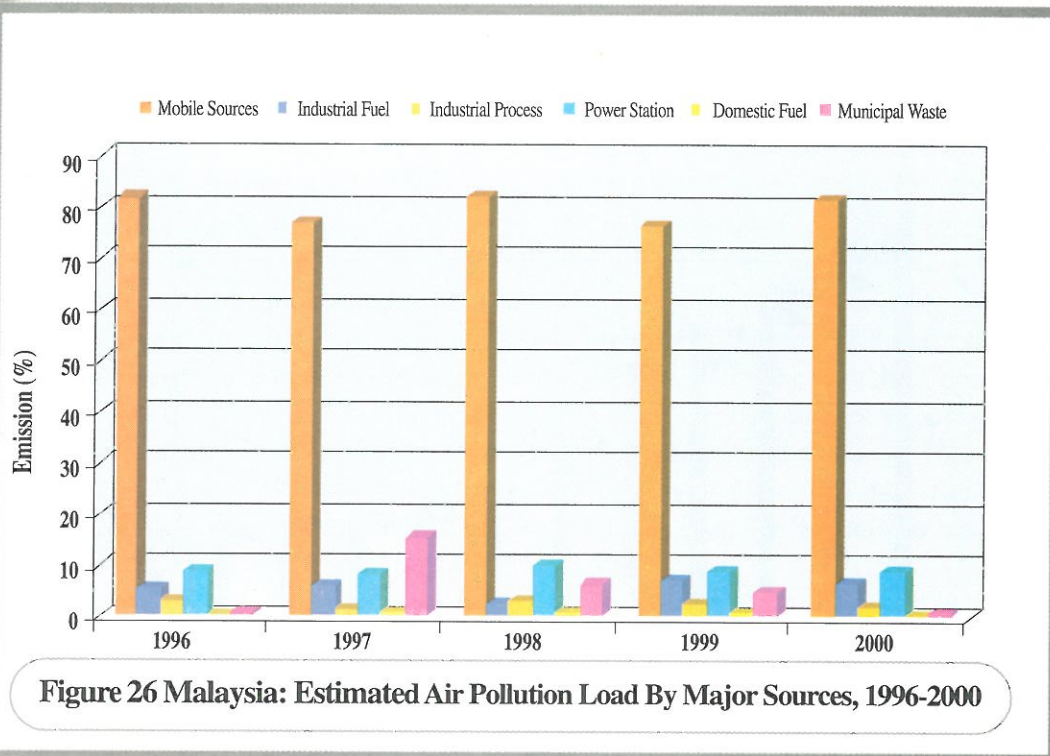


Figure 23 Malaysia: Estimated BOD Load from Major Sources, 1996-2000



SCHEDULED WASTE INVENTORY

In the year 2000, 344,550.34 tonnes of scheduled wastes generated were notified to DOE by 3,493 waste generators comprising mainly of industries, medical centres, workshops and scheduled waste contractors. The breakdown according to waste category and type of industry is given in **Figures 27 and 28** respectively. Of the 344,550.34 tonnes of scheduled wastes reported, 84,321.00 tonnes (24.5%) were treated and disposed at Kualiti Alam Sdn. Bhd; 3,780.82 tonnes (1.1%) of clinical wastes were disposed at licenced clinical waste incinerators; 4,878.02 tonnes (1.4%) were exported to foreign recovery facilities; 120,570.96 tonnes (35.0%) were delivered to local recovery facilities. About 130,988.04 tonnes (38.0%) were stored or treated at on-site facilities (**Table 7**).



*Photo 17:
Storage of Scheduled waste
(DOE Photo Library)*

Table 7 : Handling of Scheduled Wastes, 2000

Facility	Tonnes
Kualiti Alam	84321.00
Clinical waste incinerators	3780.82
Export to foreign recovery facilities	4878.02
Delivered to local recovery facilities	120570.96
On-site storage/treatment	130998.04
Total	344550.34

The Basel Convention on Transboundary Movement of Hazardous Wastes and Their Disposal

As a Party to the Basel Convention, the transboundary movement of scheduled wastes from and into Malaysia, primarily those destined for recovery or reuse is strictly regulated by DOE. A total of 4,878.02 tonnes of scheduled wastes (**Figure 29**) were allowed to be exported after prior written consent was obtained from the importing States. The types of wastes exported were mainly spent industrial catalysts, spent nickel-cadmium batteries and metal hydroxide sludges. Six written approvals were issued for imports of 125,875.00 tonnes of scheduled wastes comprising of spent fluid cracking catalyst, granulated blast furnace slag and copper slag. The catalysts and furnace slag were used as raw materials in cement manufacturing plants and copper slag as a blasting material. **Figure 30** shows the quantities of wastes (copper slag, furnace slag, fluid cracking catalyst) imported between 1996-2000.

The Malaysian Government also agreed to the ratification of the amendment to the Basel Convention pertaining to the prohibition of export of hazardous waste from Annex VII (OECD countries) to non-Annex VII (non-OECD countries).



*Photo 18:
Clinical waste disposal facility
(DOE Photo Library)*

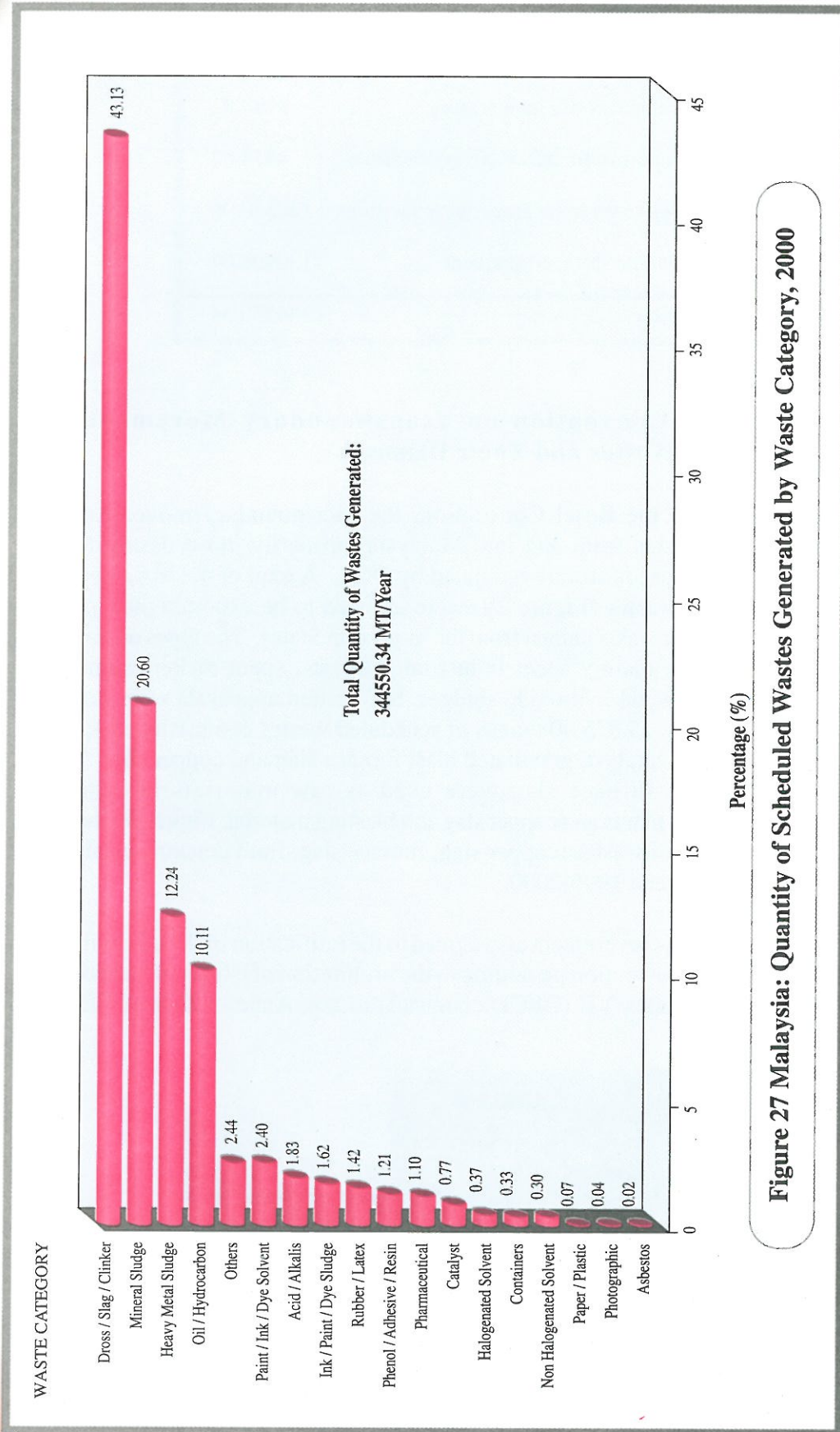


Figure 27 Malaysia: Quantity of Scheduled Wastes Generated by Waste Category, 2000

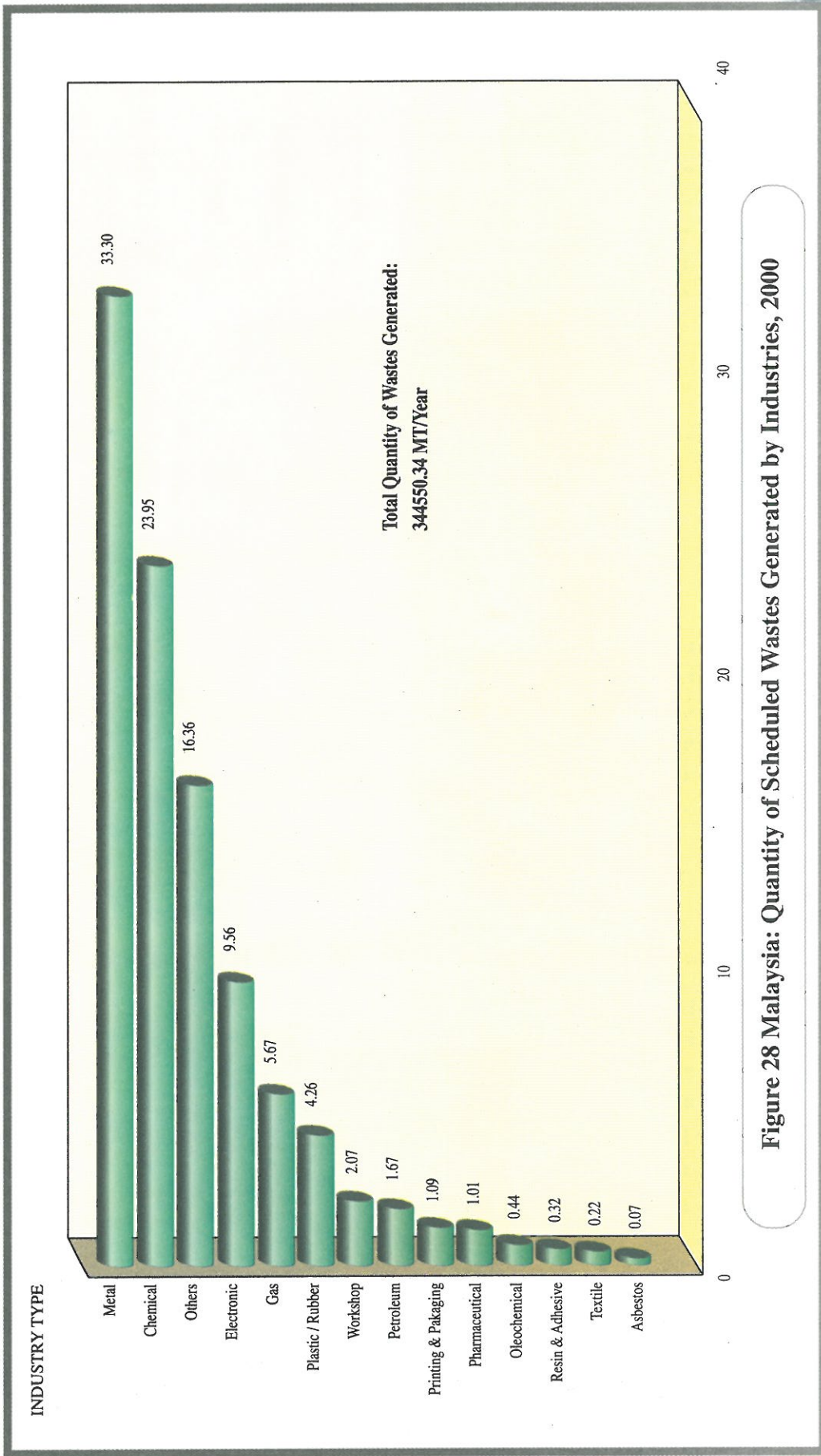


Figure 28 Malaysia: Quantity of Scheduled Wastes Generated by Industries, 2000

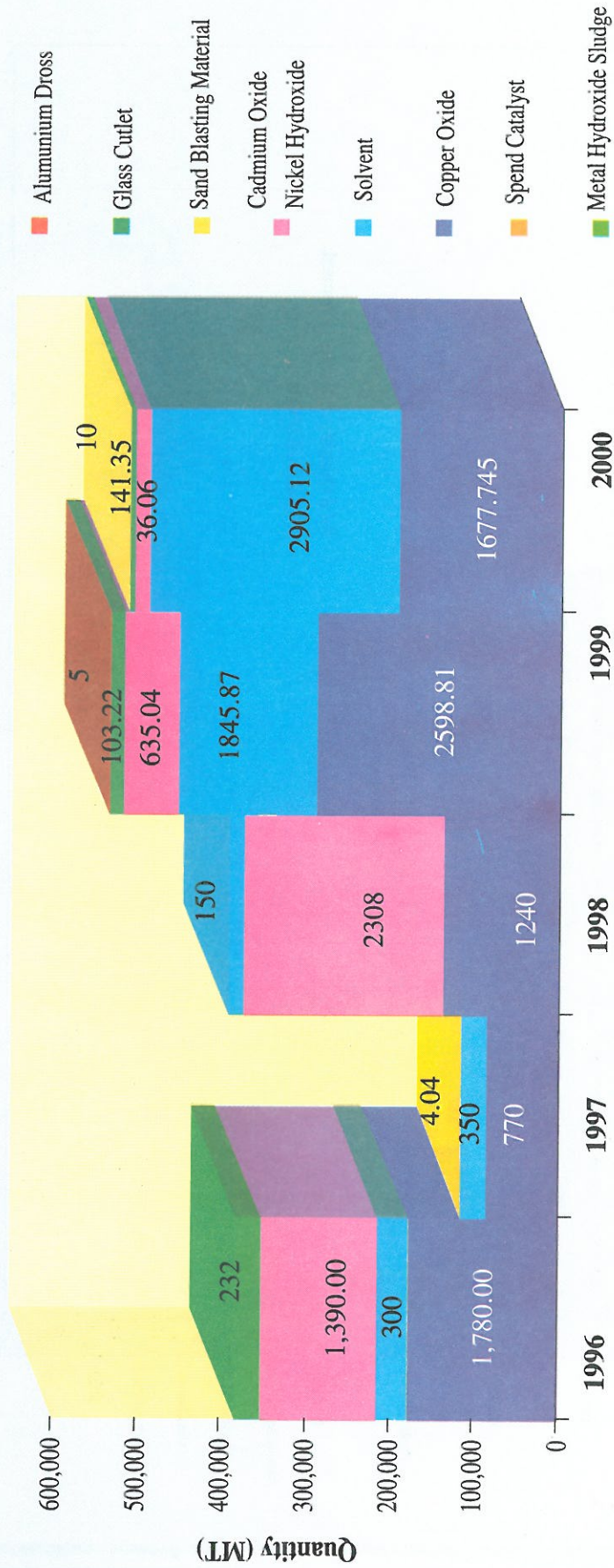


Figure 29 Malaysia: Quantity of Wastes Exported, 1996-2000

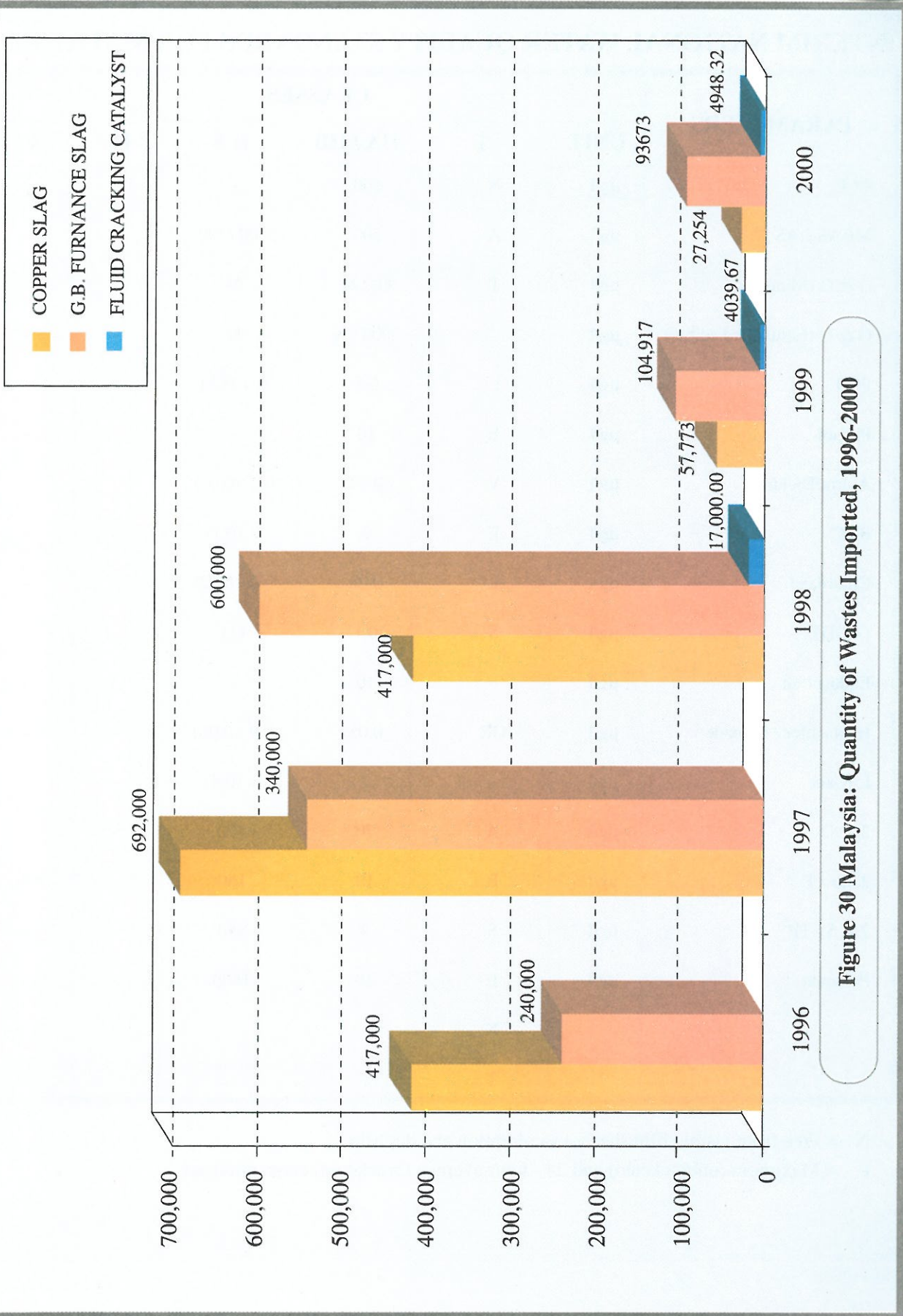


Figure 30 Malaysia: Quantity of Wastes Imported, 1996-2000

ANNEX

INTERIM NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

PARAMETERS	CLASSES					
	UNIT	I	IIA / IIB	II #	IV	V
CCE	µg/l	N	500	-	-	-
MBAS/BAS	µg/l	A	500	5000 (200)	-	-
O & G (Mineral)	µg/l	T	40 ; N	N	-	-
O & G (Emulsified edible)	µg/l		7000 ; N	N	-	-
PCB	µg/l	L	0.1	6 (0.05)	-	-
Phenol	µg/l	E	10	-	-	-
Aldrin/Dieldrin	µg/l	V	0.02	0.2 (0.01)	-	-
BHC	µg/l	E	2	9 (0.1)	-	-
Chlordane	µg/l	L	0.08	2 (0.02)	-	-
t - DDT	µg/l	S	0.1	(1)	-	-
Endosulfan	µg/l		10	-	-	-
Heptachlor / Epoxide	µg/l	OR	0.05	0.9 (0.06)	-	-
Lindane	µg/l		2	3 (0.4)	-	-
2,4 -D	µg/l	A	70	450	-	-
2,4,5 - T	µg/l	B	10	160	-	-
2,4, 5 - TP	µg/l	S	4	850	-	-
Paraquat	µg/l	E	10	1800	-	-
		N				
		T				

N = Free from visible film sheen, discoloration and deposits

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

ANNEX

INTERIM NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

PARAMETERS	CLASSES						
	UNIT	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 (2000) ^a	5000 (20000) ^a	-
Total Coliform	counts/100mL	100	5000	5000	5000	50000	>50000

Notes

- N : No visible floatable materials or debris or No objectionable odour, or 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 I - 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 species of economic value and tolerant species; livestock drinking
 CLASS IV : Irrigation
 CLASS V : Water unsuitable for any of the above uses.

DOE WATER QUALITY INDEX CLASSES

Parameter	Class	I	II	III	IV	V
Ammoniacal Nitrogen (NH ₃ -N)	mg/l	< 0.1	0.1 - 0.3	0.3 - 0.9	0.9 - 2.7	> 2.7
Biochemical Oxygen Demand (BOD)	mg/l	< 1	1 - 3	3 - 6	6 - 12	> 12
Chemical Oxygen Demand (COD)	mg/l	< 10	10 - 25	25 - 50	50 - 100	> 100
Dissolved Oxygen (DO)	mg/l	> 7	5 - 7	3 - 5	1 - 3	< 1
pH	mg/l	> 7	6 - 7	5.6	< 5	> 5
Suspended Solids (SS)	mg/l	< 25	25 - 50	50 - 150	150 - 300	> 300
Water Quality Index (WQI)		> 92.7	76.5 - 92.7	51.9 - 76.5	31.0 - 51.9	< 31.0

Parameter	Index Range		
	Clean	Slightly Polluted	
Water Quality Index (WQI)	81 - 100	60 - 80	0 - 59
Biochemical Oxygen Demand (BOD)	91 - 100	80 - 90	0 - 79
Ammoniacal Nitrogen (NH ₃ -N)	92 - 100	71 - 91	0 - 70
Suspended Solids (SS)	76 - 100	70 - 75	0 - 69

