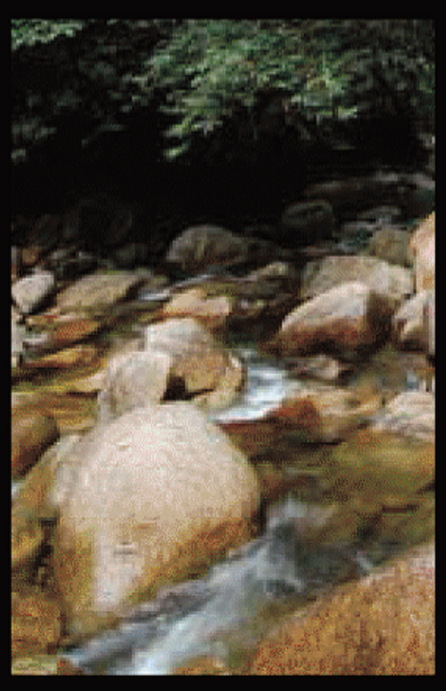
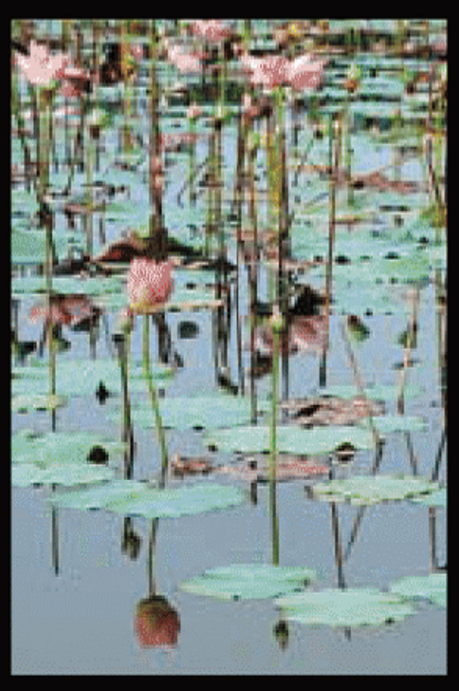
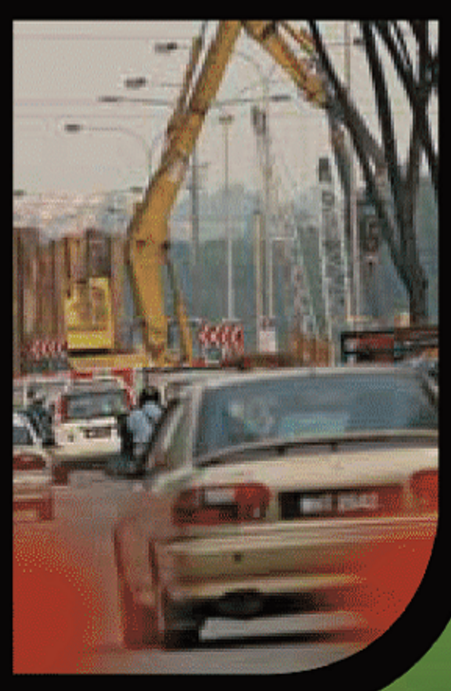
DEPARTMENT OF ENVIRONMENT







MALAYSIA Environmental Quality Report 2009

MALAYSIA
Environmental Quality Report
2009

Department of Environment
Ministry of Natural Resources and Environment
Malaysia

Department of Environment, Malaysia

Department of Environment, Malaysia

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

Contents

Foreword

In compliance with Section 3(1)(i) of the Environmental Quality Act 1974, the 2009 Environmental Quality Report is hereby published.

Compared to 2008, there was a slight deterioration in river water quality. There was a reduction in the number of clean rivers compared with 2008. There were 306 clean rivers in 2009 as compared with 334 in 2008 while the number of slightly polluted rivers increased from 197 to 217. There was also an increase in the number of polluted rivers from 48 in 2008 to 54 in 2009. However, the quality of the marine environment with respect to coastal and estuarine areas were within normal variations compared with the Malaysian Marine Water Quality Criteria and Standard (MWQCS).

Based on the Air Pollutant Index (API), the overall air quality for Malaysia in 2009 was between good and moderate level most of the time. However, there was a slight decrease in the number of good air quality days recorded in 2009 at 56 percent compared to 59 percent in 2008. This is partly due to peatland fires and transboundary air pollution that occurred during hot and dry weather conditions.

The Department of Environment will continue to strengthen and implement its strategies, programs and activities effectively in managing the environment sustainably. Foremost in our agenda is to ensure that the environment remain clean, safe, healthy and productive, both ecologically and environmentally, in order to support socio – economic development of the country.

“Environmental Conservation, Our Shared Responsibility”

With best wishes,

Dato’ Hajah Rosnani Ibarahim
Director General of Environmental Quality
Malaysia

30 June 2010

Chapter 1: Air Quality

Chapter 1 : Air Quality

AIR QUALITY MONITORING

The Department of Environment (DOE) monitors the country's ambient air quality through a network of 51 continuous monitoring stations **(Map 1.1 and Map 1.2)**. These monitoring stations are strategically located in residential, urban and industrial areas to detect any significant change in the air quality which may be harmful to human health and the environment.

Table 1.1 Malaysia: Air Pollutant Index (API)

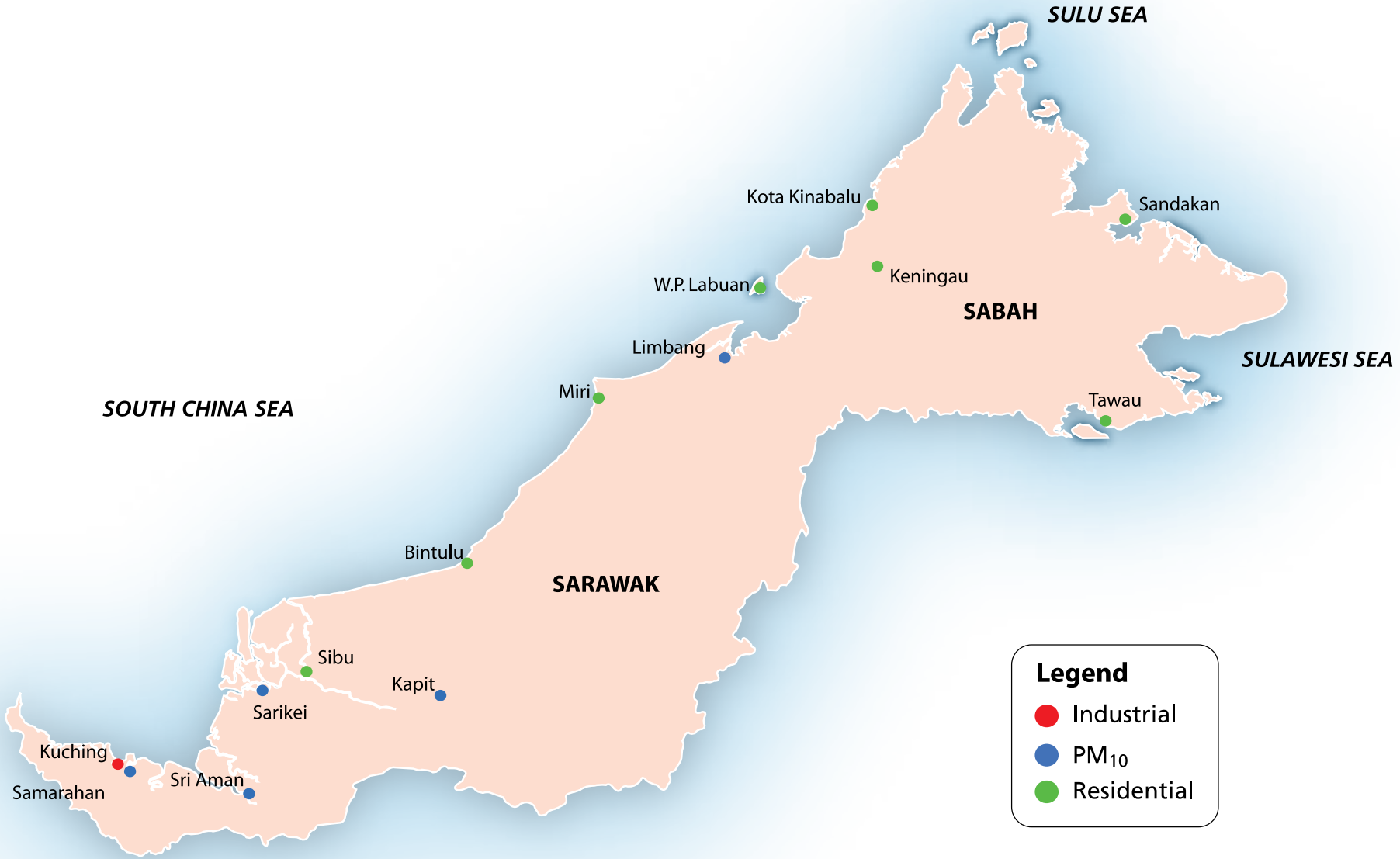
API	AIR QUALITY STATUS
0 – 50	Good
51 – 100	Moderate
101 – 200	Unhealthy
201 – 300	Very Unhealthy
> 300	Hazardous

A view of Seri Perdana, Putrajaya on a clear bright day

In addition to the 51 stations in the National Continuous Air Quality Monitoring Network, manual air quality monitoring stations using High Volume Samplers were also established at 21 different sites for measuring total suspended particulates, particulate matter (PM_{10}) and heavy metals such as lead.

The air quality status is reported in terms of Air Pollutant Index (API). The air pollutants used in computing the API are ground level ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and particulate matter of less than 10 microns in size (PM_{10}). The API is categorized as good, moderate, unhealthy, very unhealthy and hazardous as presented in **Table 1.1**.

Map 1.1 Malaysia : Location of Continuous Air Quality Monitoring Stations, Peninsular Malaysia, 2009



Map 1.2 Malaysia: Location of Continuous Air Quality Monitoring Stations, East Malaysia, 2009

Canopy of green with good air quality

AIR QUALITY STATUS

Based on the Air Pollutant Index (API), the overall air quality for Malaysia in 2009 was between good to moderate levels most of the time. However, there was a slight decrease in the number of good air quality days recorded in 2009 (55.6 percent of the time) compared to that in 2008 (59 percent of the time) while remaining 43 percent at moderate level and only 1.4 percent at unhealthy level. This is partly due to peatland fires and transboundary air pollution that occurred during the hot and dry weather conditions (moderate to strong El Nino) experienced in the region during the months of June to August which resulted in a short spell of haze episode.

Table 1.2 Malaysia : Ambient Air Quality Guidelines

Pollutant	Averaging Time	Malaysia Guidelines	
		ppm	($\mu g/m^3$)
Ozone	1 Hour 8 Hour	0.10 0.06	200 120
Carbon Monoxide**	1 Hour 8 Hour	30.0 9.0	35 10
Nitrogen Dioxide	1 Hour 24 hour	0.17 0.04	320
Sulphur Dioxide	1 hour 24 Hour	0.13 0.04	350 105
Particulate Matter (PM_{10})	24 Hour 12 Month		150 50
Total Suspended Particulate (TSP)	24 Hour 12 Month		260 90
Lead	3 Month		1.5

Note: **(mg/m^3)

The annual average concentrations of air pollutants measured namely CO, NO_2, O_3, SO_2 and PM_{10} were found to be below the stipulated levels of the Malaysian Ambient Air Quality Guidelines **(Table 1.2)**.

Besides PM_{10}, O_3 remained the pollutant of concerned due to the conducive atmospheric condition and emission from motor vehicles in urban areas that enhance its formation. These resulted in several unhealthy days recorded at various locations in the Klang Valley and in the States of Melaka, Negeri Sembilan, Perak, Pulau Pinang, Johor and Sabah.

On some days the daily maximum 1-hour concentration of O_3 exceeded the Malaysian Ambient Air Quality Guidelines for several stations in the Klang Valley, as shown in **Figure 1.1(a)** and **Figure 1.1(b)**. These conditions led to a number of unhealthy days recorded in those stations located in areas of central business districts with heavy traffic volume.

With respect to PM_{10}, the daily concentrations of PM_{10} in Klang occasionally exceeded the guidelines value as shown in **Figure 1.1(c)** due to unfavourable weather conditions of hot and dry periods. However, the daily concentrations of PM_{10} in other areas were found to be in compliance to the Malaysian Ambient Air Quality Guidelines. **Figure 1.1(d)** shows the daily concentrations of PM_{10} for Klang in comparison with selected stations in sub-urban and rural areas which recorded lower levels of PM_{10}.

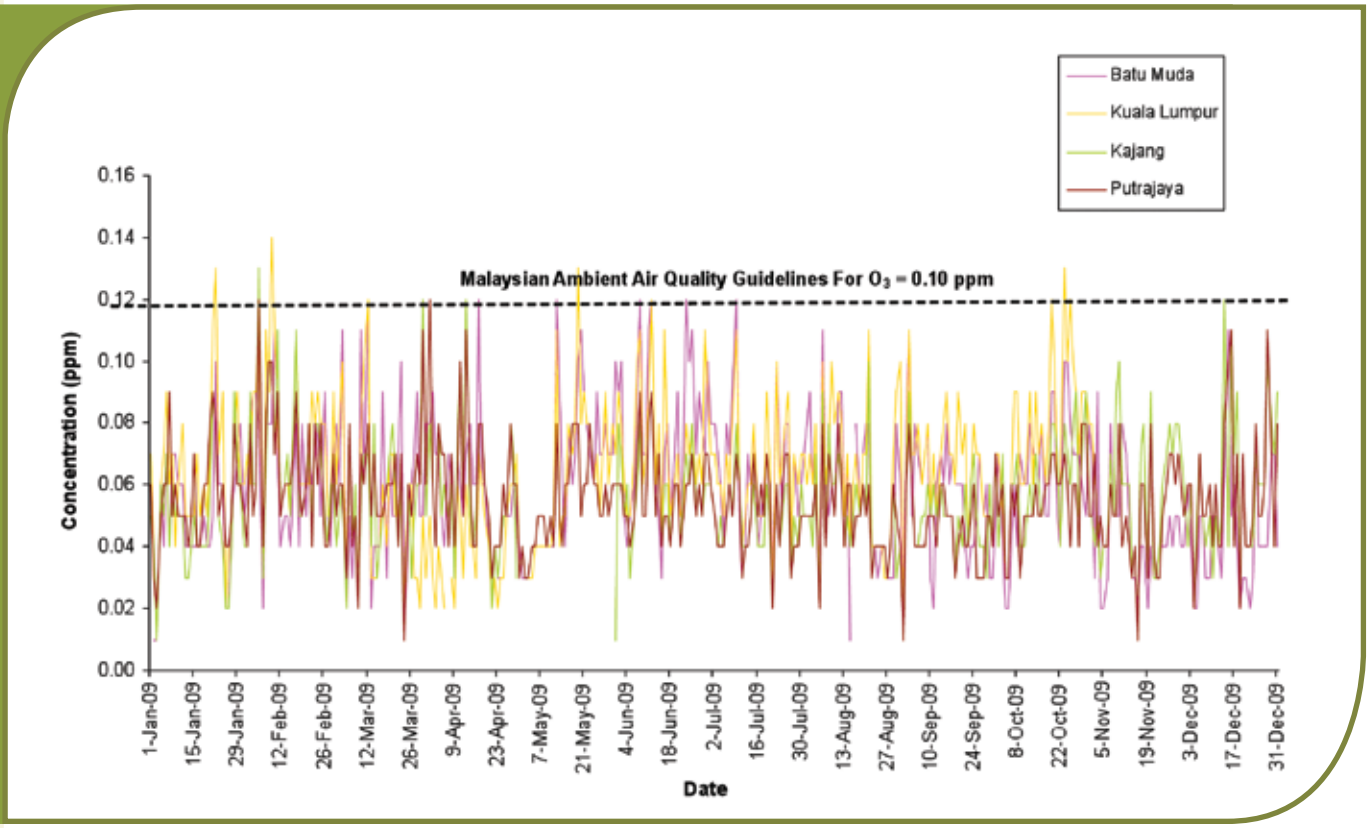


Figure 1.1(a) Malaysia : Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Klang Valley, 2009

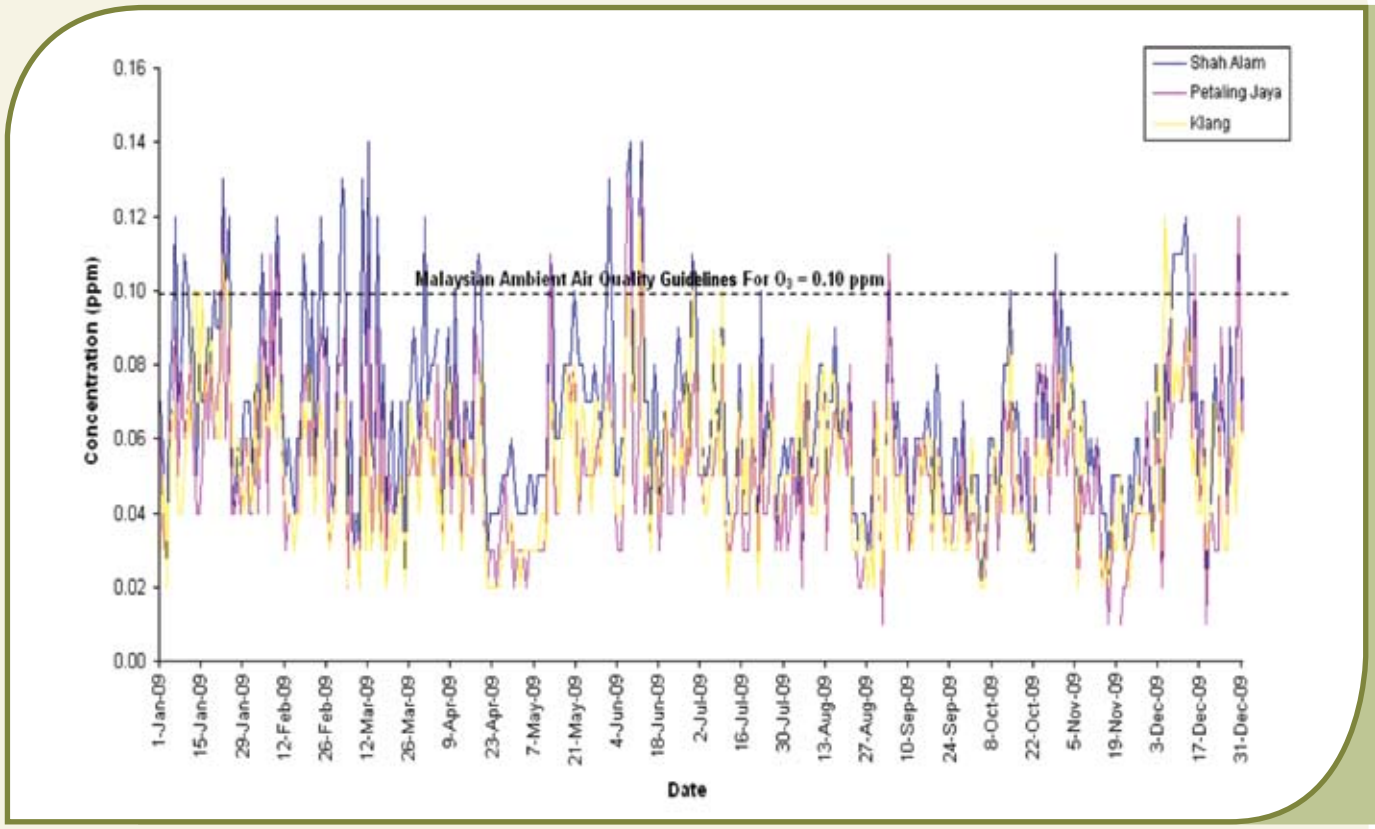


Figure 1.1(b) Malaysia : Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Klang Valley, 2009

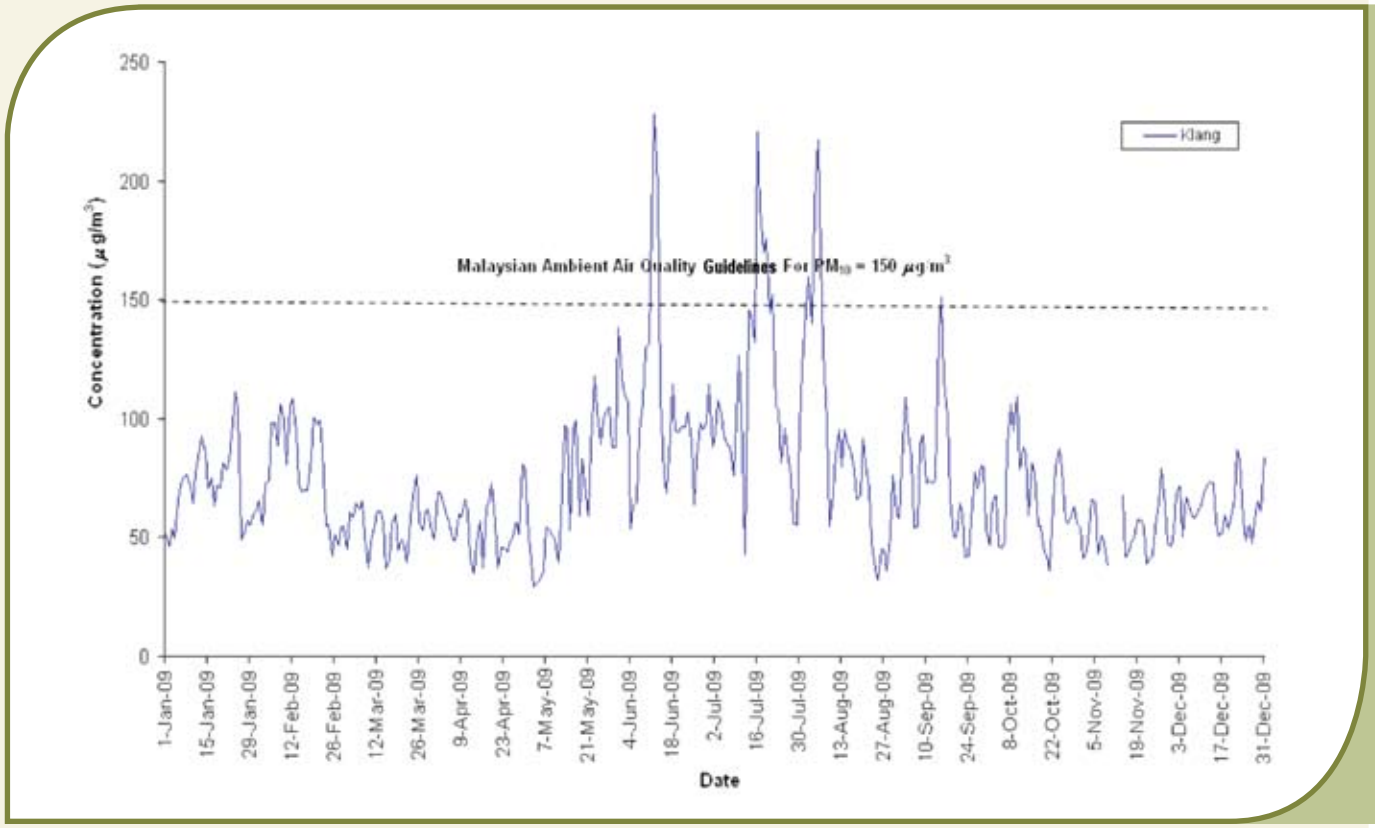


Figure 1.1(c) Malaysia : Trend of 24-hour Concentration of Particulate Matter (PM_{10}), Klang, 2009

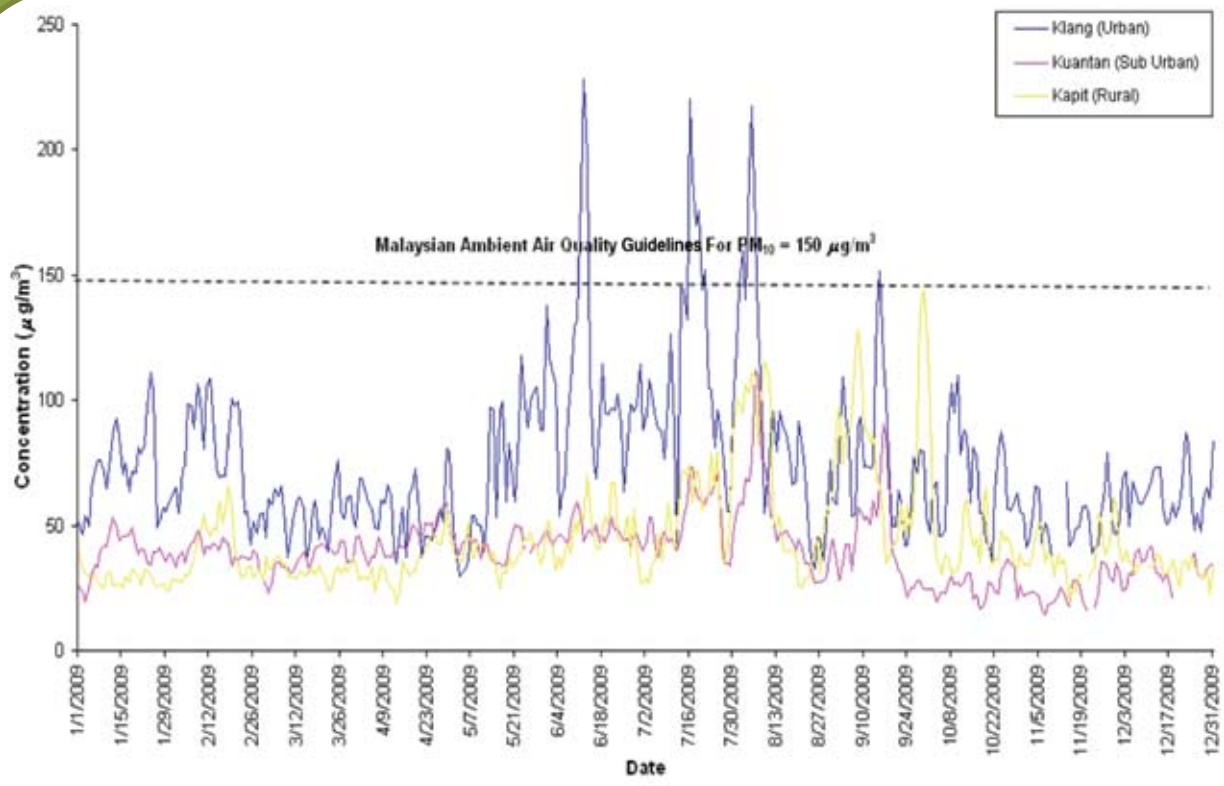
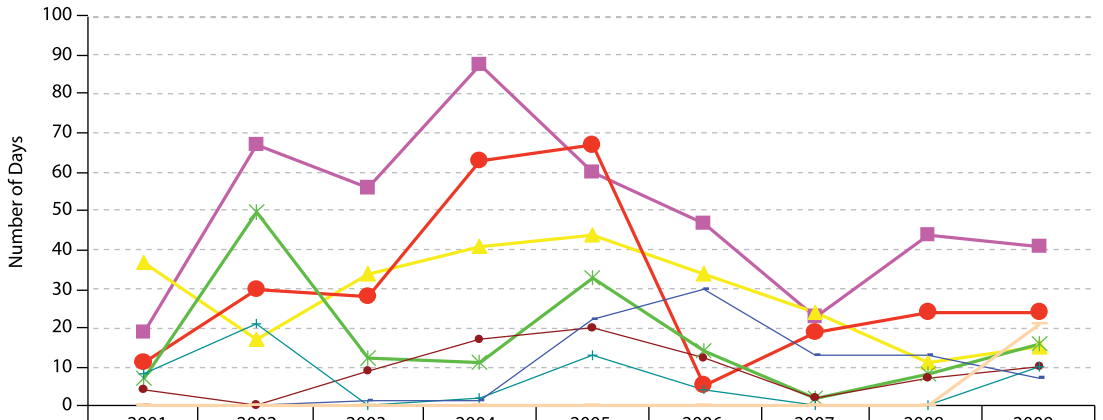


Figure 1.1(d) Malaysia : Trend of 24-hour Concentration of Particulate Matter (PM_{10}), Klang and Selected Sub Urban/Rural Areas, 2009



	2001	2002	2003	2004	2005	2006	2007	2008	2009
Shah Alam	19	67	56	88	60	47	23	44	41
Kajang	37	17	34	41	44	34	24	11	15
Kuala Lumpur	11	30	28	63	67	5	19	24	24
Klang	7	50	12	11	33	14	2	8	16
Petaling Jaya	4	0	9	17	20	12	2	7	10
Kuala Selangor	8	21	0	2	13	4	0	0	10
Putrajaya	0	0	1	1	22	30	13	13	7
Batu Muda*	0	0	0	0	0	0	0	0	21

*Note: *Previous station in Gombak was replaced with Batu Muda and started operation in 2009*

Figure 1.1 Malaysia : Number of Unhealthy Days, Klang Valley, 2001 - 2009

Air Quality Status in the West Coast

Klang Valley

In 2009, the air quality in the Klang Valley was good 29 percent of the time, moderate 66 percent and the remaining five (5) percent at an unhealthy level. The highest number of unhealthy days was recorded in Shah Alam (41 days) **(Figure 1.1)** as compared to 44 days in 2008. The unhealthy days recorded were due to the ground level Ozone (O_3). In Klang area, the unhealthy days were caused by particulate matter (PM_{10}) due to peatland burning during the dry period. The overall air quality status in Klang Valley is shown in **Figure 1.2**.

Northern Region

The overall air quality of the northern region of the West Coast of Malaysia (Perlis, Kedah, Pulau Pinang and Perak), was between good to moderate most of the time. However Tanjung Malim recorded 24 unhealthy days while Tasek, Ipoh, Manjung, Seberang Jaya and Prai recorded 1 unhealthy day, each. The pollutants of concerned were particulate matter (PM_{10}) and ground level Ozone (O_3).

Southern Region

In the southern region of the West Coast of Peninsular Malaysia (Negeri Sembilan, Melaka and Johor) the air quality was also between good to moderate most of the time, with the exception of a few unhealthy days recorded in Port Dickson (3 days), Bukit Rambai (3 days), Bandaraya Melaka (6 days), Nilai (1 day), Muar (5 days) and Pasir Gudang (5 days). The pollutants of concerned were particulate matter (PM_{10}) and ground level Ozone (O_3). **Figure 1.3** shows the overall air quality status for the West Coast of Peninsular Malaysia.

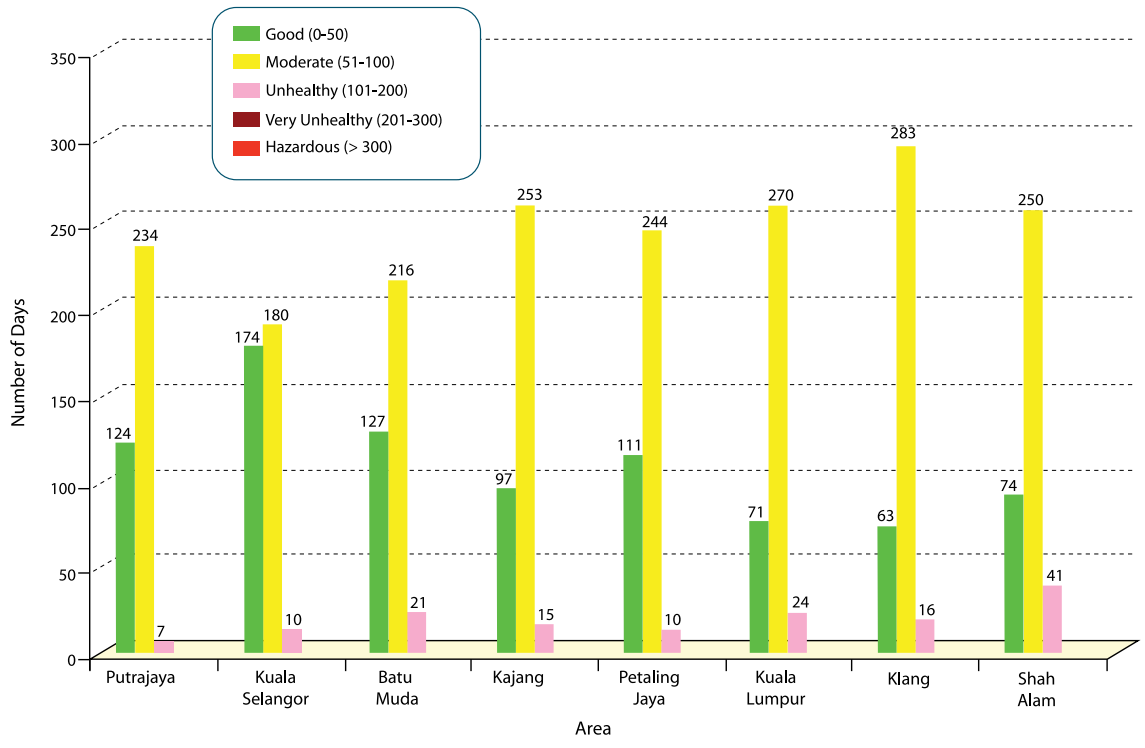


Figure 1.2 Malaysia : Klang Valley Air Quality Status, 2009

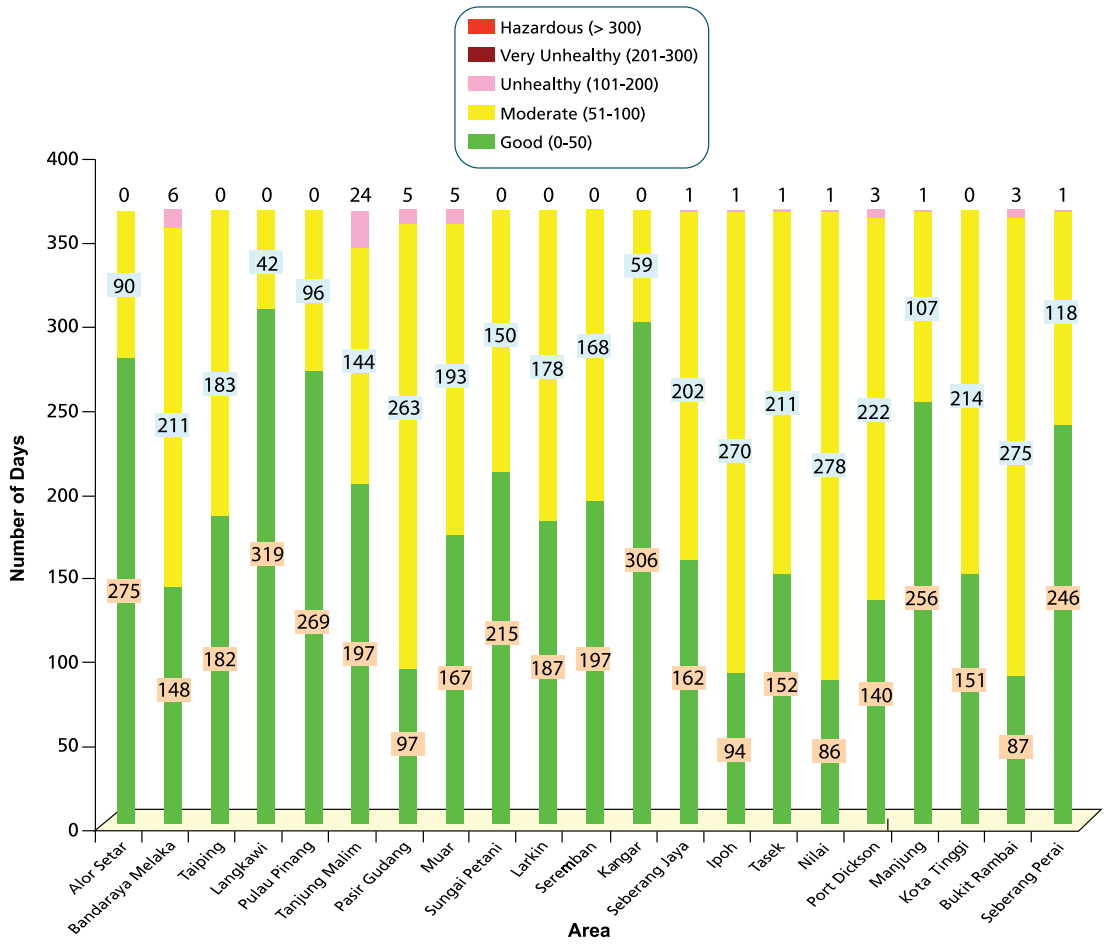


Figure 1.3 Malaysia : Air Quality Status, West Coast Peninsular Malaysia, 2009

Air Quality Status in the East Coast

In the East Coast of Peninsular Malaysia (Pahang, Terengganu and Kelantan) the air quality remained good most of the time and occasionally moderate. Only Balok Baru in Pahang which is located in an industrial area recorded 2 unhealthy days due to high level of particulate matter (PM_{10}). The overall air quality status in the East Coast of Peninsular Malaysia is shown in **Figure 1.4**.

Air Quality Status in Sabah, Labuan and Sarawak

The air quality in Sabah, Labuan and Sarawak was generally good and moderate. Several areas in Kuching, Sibu, Miri, Bintulu, Sri Aman and Samarahan, Sarawak recorded unhealthy status in August 2009 due to peatland fires and land and forest fires in West Kalimantan as reported by the ASEAN Specialized Meteorological Centre (ASMC). The overall air quality status in Sabah, Labuan and Sarawak is shown in **Figure 1.5**.

AIR QUALITY TREND

Five (5) air pollutants, namely Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Ozone (O_3), Sulphur Dioxide (SO_2) and Particulate Matter (PM_{10}) were monitored continuously at 51 locations. The air quality trend for the period of 1998 to 2009 was computed by averaging direct measurements from the monitoring sites on a yearly basis and cross-reference with the Malaysian Ambient Air Quality Guidelines as shown in **Table 1.2**.

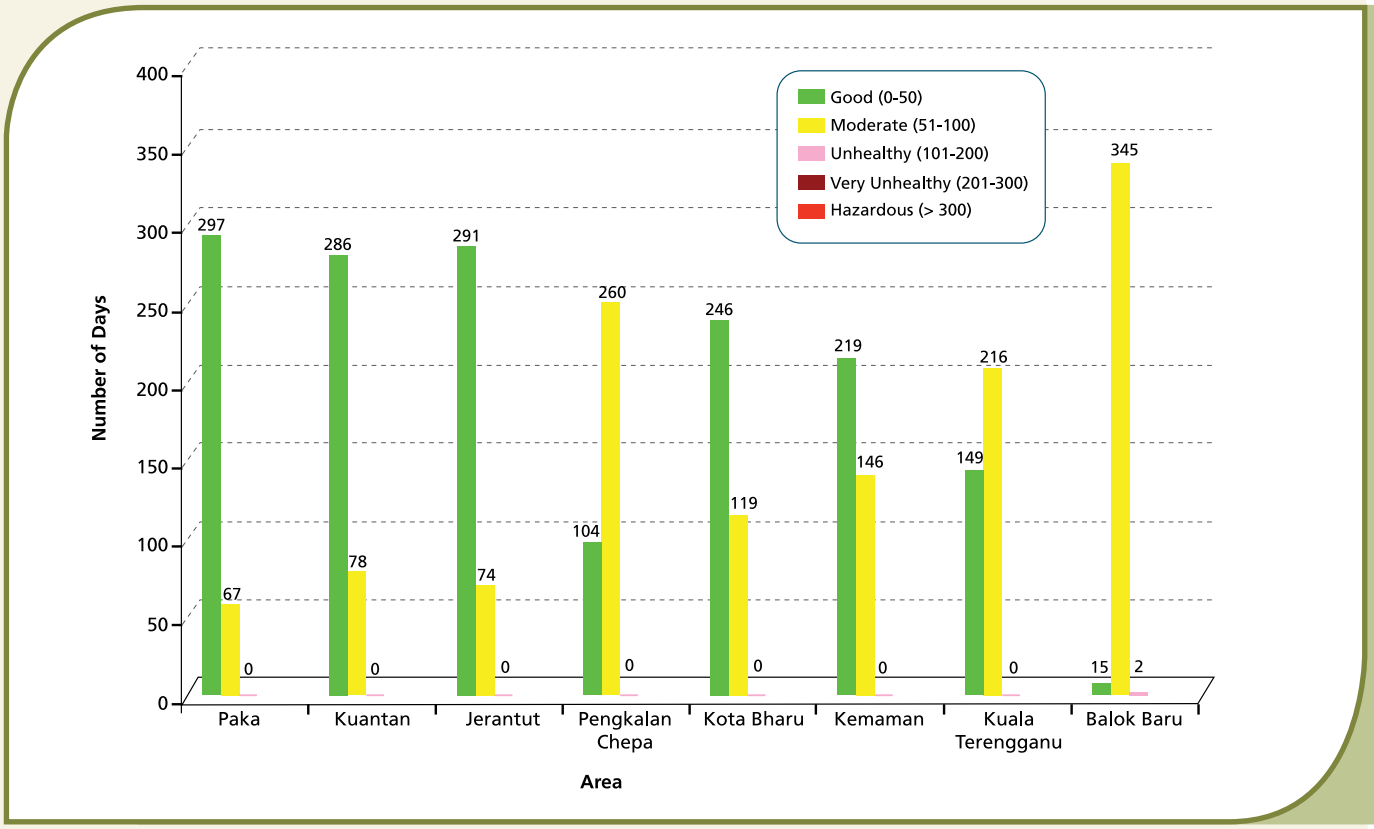


Figure 1.4 Malaysia : Air Quality Status, East Coast Peninsular Malaysia, 2009

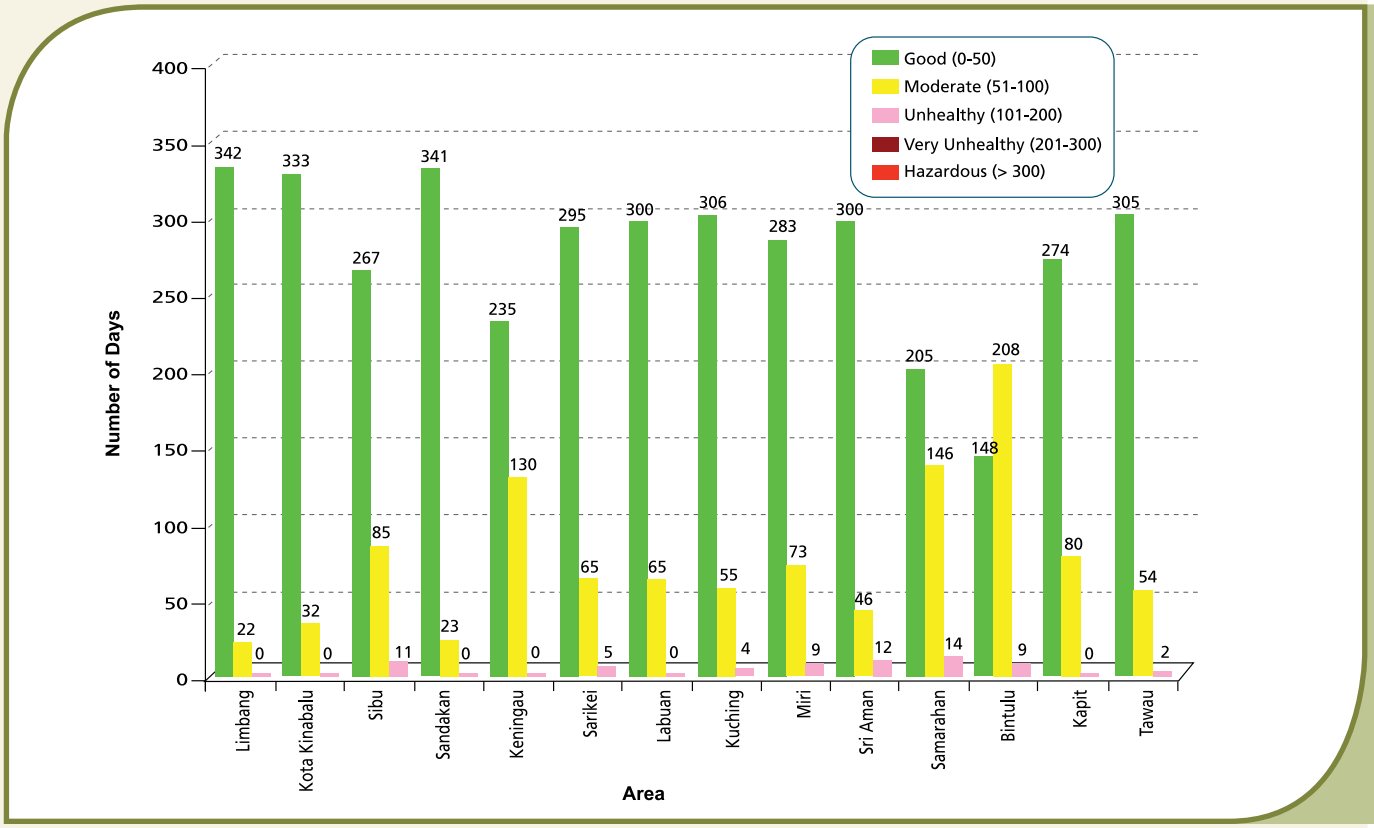


Figure 1.5 Malaysia : Air Quality Status in Sabah, Labuan and Sarawak, 2009

Particulate Matter (PM_{10})

In 2009 the annual average value of PM_{10} was 44 µg/m^3 which is below the Malaysian Ambient Air Quality Guidelines value of 50 µg/m^3. There was no significant change compared to the annual average of PM_{10} (42 µg/m^3) in 2008. Incidences of local peatland fires and transboundary haze had contributed to a higher level of PM_{10} recorded intermittently in several areas in Selangor and Sarawak from June to August 2009.

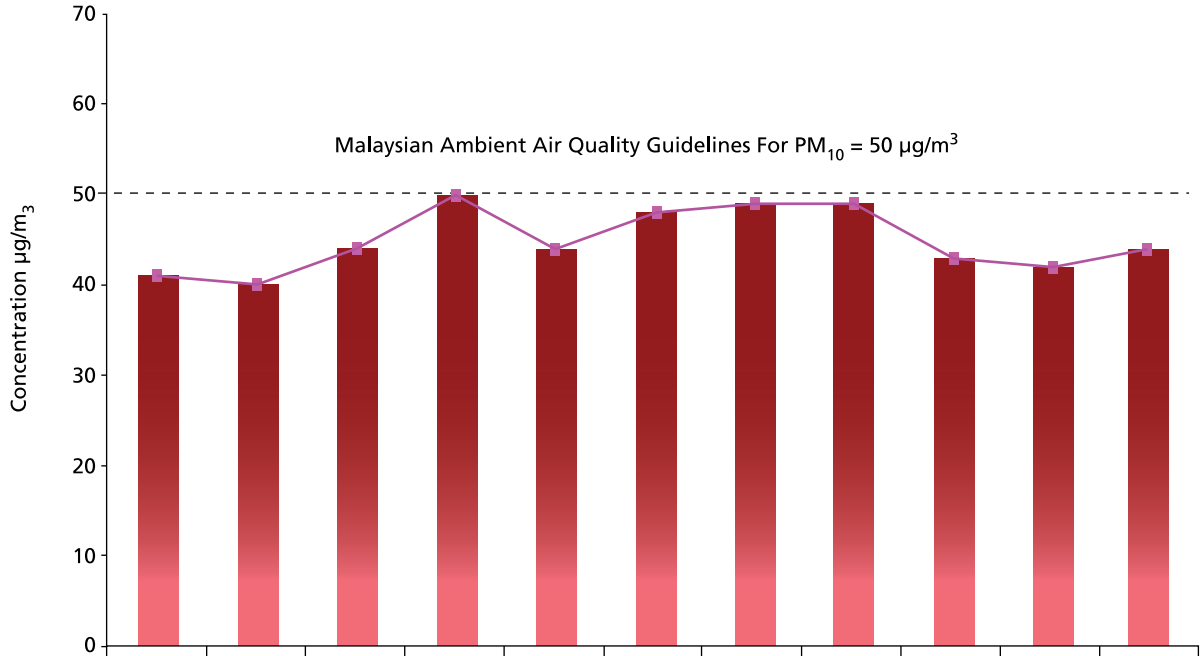
The trend of the annual average levels of PM_{10} concentration in the ambient air between 1999 and 2009 complied to the Malaysian Ambient Air Quality Guidelines as shown in **Figure 1.6**. Based on land use categories, PM_{10} concentration was also below the Malaysian Ambient Air Quality Guidelines as shown in **Figure 1.6(a)**.

Sulphur Dioxide (SO_2)

Generally the annual average SO_2 concentration shows a declining trend between 1999 and 2009 **(Figure 1.7)**. It is well below the Malaysian Ambient Air Quality Guidelines. This could be attributed to stricter enforcement by the DOE as well as more widely use of natural gas for industrial combustion process and vehicles. **Figure 1.7(a)** shows the annual average concentrations of sulphur dioxide for different categories of land use.

Nitrogen Dioxide (NO_2)

In 2009, there was no significant change of NO_2 concentration compared to the 2008 level. The NO_2 concentrations remain high in urban and industrial areas mainly due to a significant increase in the number of motor vehicles and combustion



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Concentration	41	40	44	50	44	48	49	49	43	42	44
Number of Sites	45	50	50	50	51	51	51	51	51	51	51

Figure 1.6 Malaysia: Annual Average Concentration of Particulate Matter (PM_{10}), 1999 - 2009

Forests acting as valuable carbon sinks

processes. Estimate on NO_2 emission load indicates 28 percent is from motor vehicles, 69 percent from power stations and industries and the remaining three (3) percent from other sources.

The annual average concentrations of NO_2 in the ambient air from 1999 to 2009 remains almost constant and well below the Malaysian Ambient Air Quality Guidelines. **(Figure 1.8** and **Figure 1.8(a))**.

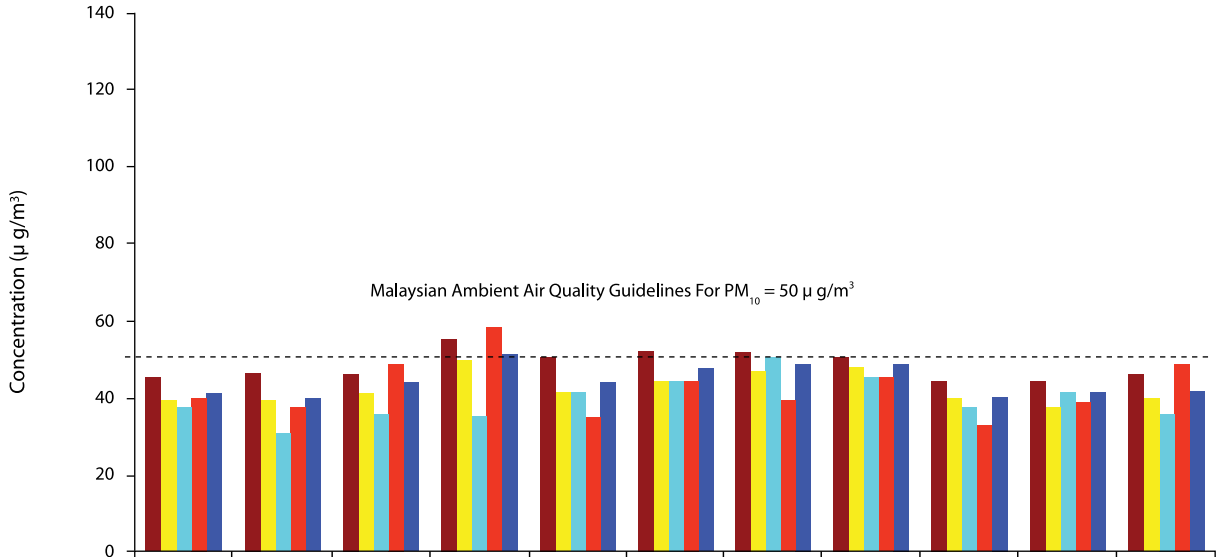
Ground Level Ozone (O_3)

In 2009, the annual average daily maximum one-hour O_3 concentrations decreased by six (6) percent compared to 2008. The annual average daily maximum one-hour O_3 concentrations in ambient air for 1999 to 2009 were well below the Malaysian Ambient Quality Guidelines as shown in **Figure 1.9**.

Figure 1.9(a) shows the O_3 concentration for various land use categories between 1999 and 2009. Urban areas recorded higher levels of O_3 due to higher traffic volume and a conducive atmospheric condition resulting in its formation.

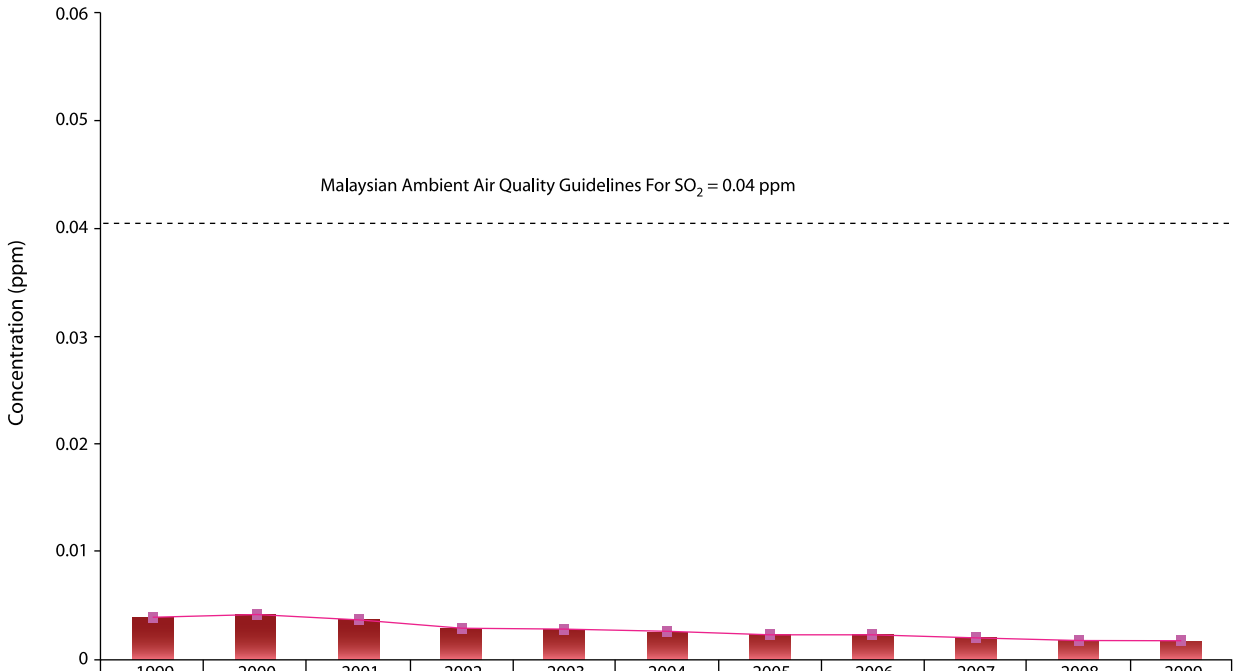
Carbon Monoxide (CO)

There was an almost 15 percent decreased in CO levels in 2009 compared to 2008. However the trend of CO concentration from 1999 to 2009 remains almost constant. The levels recorded were well below the Malaysian Ambient Air Quality Guidelines **(Figure 1.10)**. In urban areas the concentration of CO was higher where the main source of emission was motor vehicles which contributed to 95 percent of CO emission load in 2009. **Figure 1.10(a)** shows CO concentrations for various categories of land use.



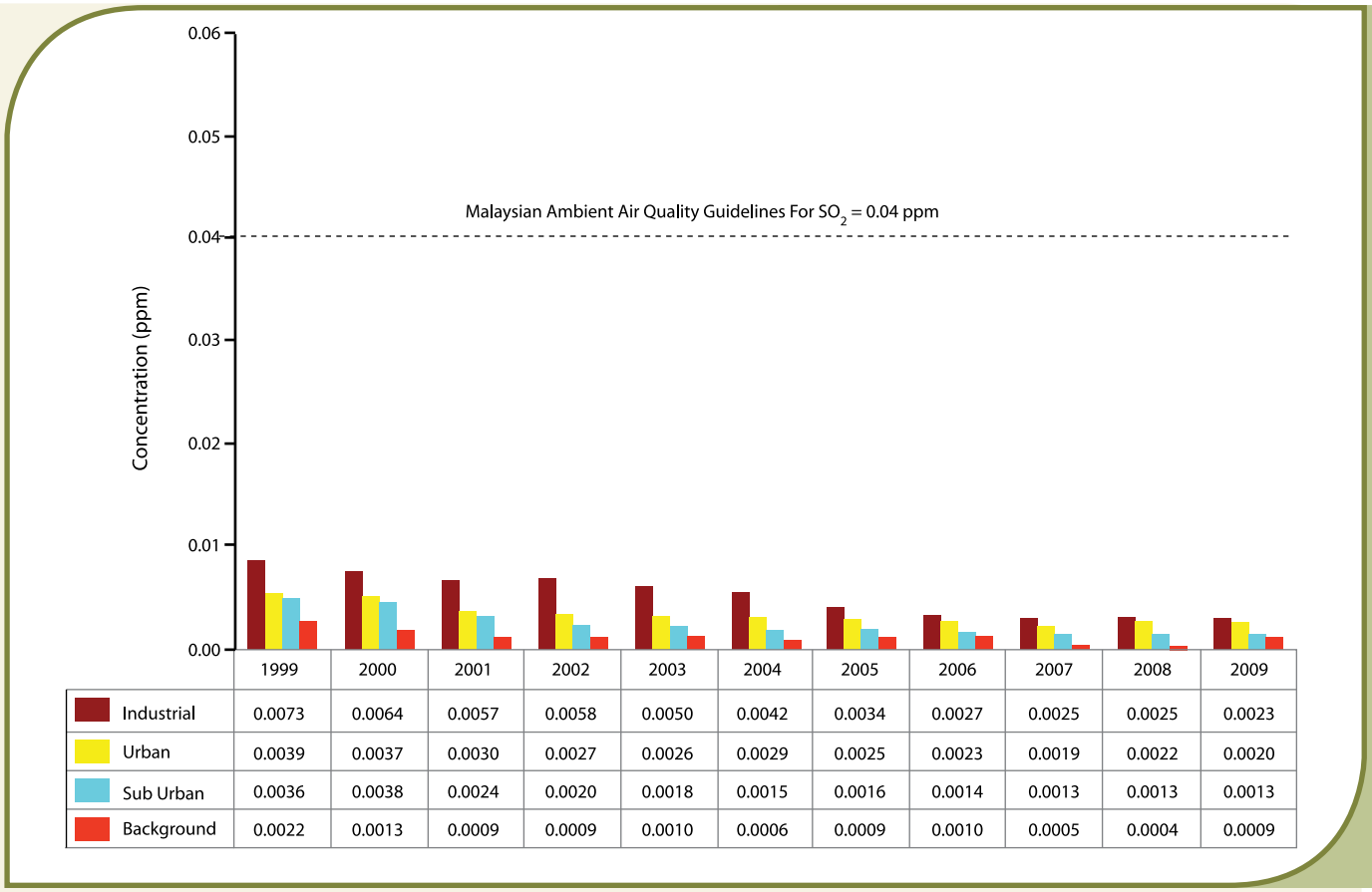
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Urban	45	46	46	55	50	52	52	50	44	44	46
Sub Urban	39	39	42	49	42	44	46	47	40	37	40
Background	38	31	36	35	42	44	50	45	38	42	36
Rural	40	38	48	58	35	44	39	45	33	39	48
Mean	41.4	39.8	43.8	50.2	43.8	47.8	48	48	40.8	41.6	42.5

Figure 1.6(a) Malaysia : Annual Average Concentration of Particulate Matter (PM_{10}) by Land Use, 1999-2009



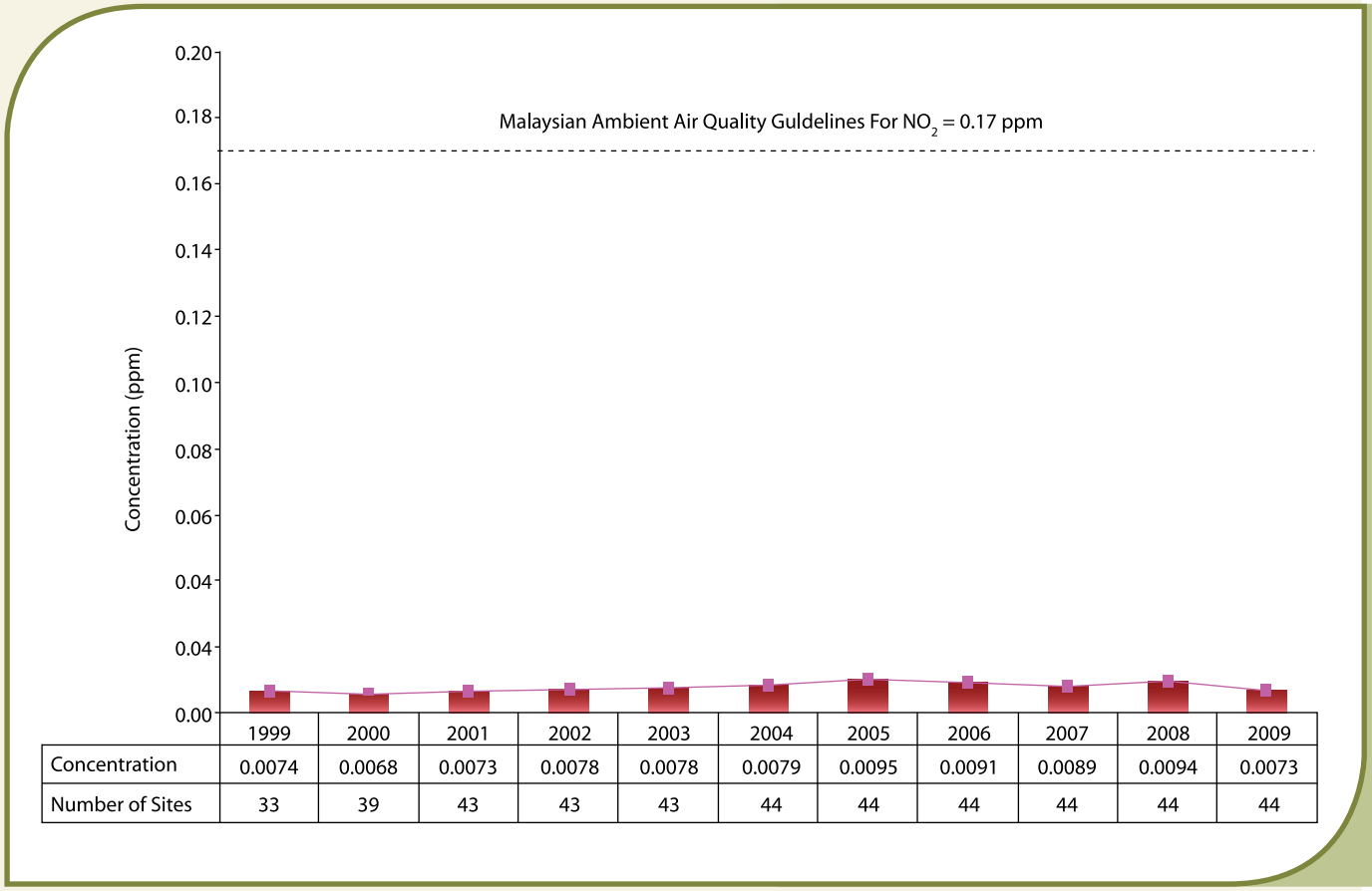
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Concentration	0.0035	0.0038	0.003	0.0029	0.0026	0.0023	0.0024	0.0021	0.0019	0.0018	0.0018
Number of Sites	39	43	43	43	44	44	44	44	44	44	44

Figure 1.7 Malaysia : Annual Average Concentration of Sulphur Dioxide (SO_2) 1999-2009



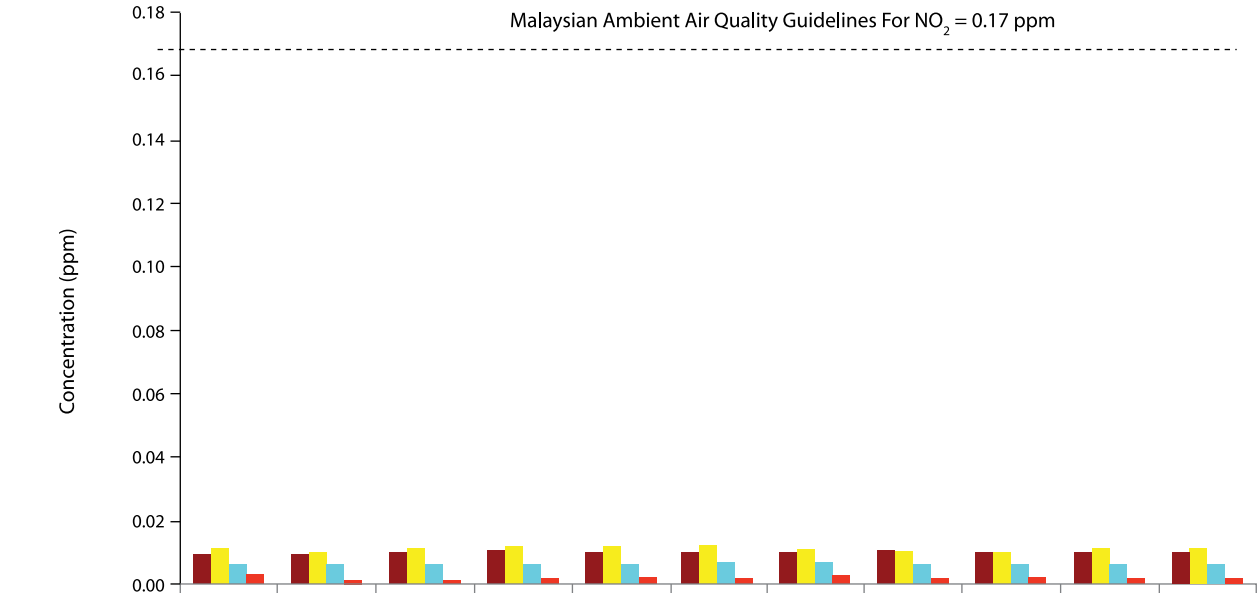
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Industrial	0.0073	0.0064	0.0057	0.0058	0.0050	0.0042	0.0034	0.0027	0.0025	0.0025	0.0023
Urban	0.0039	0.0037	0.0030	0.0027	0.0026	0.0029	0.0025	0.0023	0.0019	0.0022	0.0020
Sub Urban	0.0036	0.0038	0.0024	0.0020	0.0018	0.0015	0.0016	0.0014	0.0013	0.0013	0.0013
Background	0.0022	0.0013	0.0009	0.0009	0.0010	0.0006	0.0009	0.0010	0.0005	0.0004	0.0009

Figure 1.7(a) Malaysia: Annual Average Concentration of Sulphur Dioxide (SO_2) by Land Use, 1999-2009



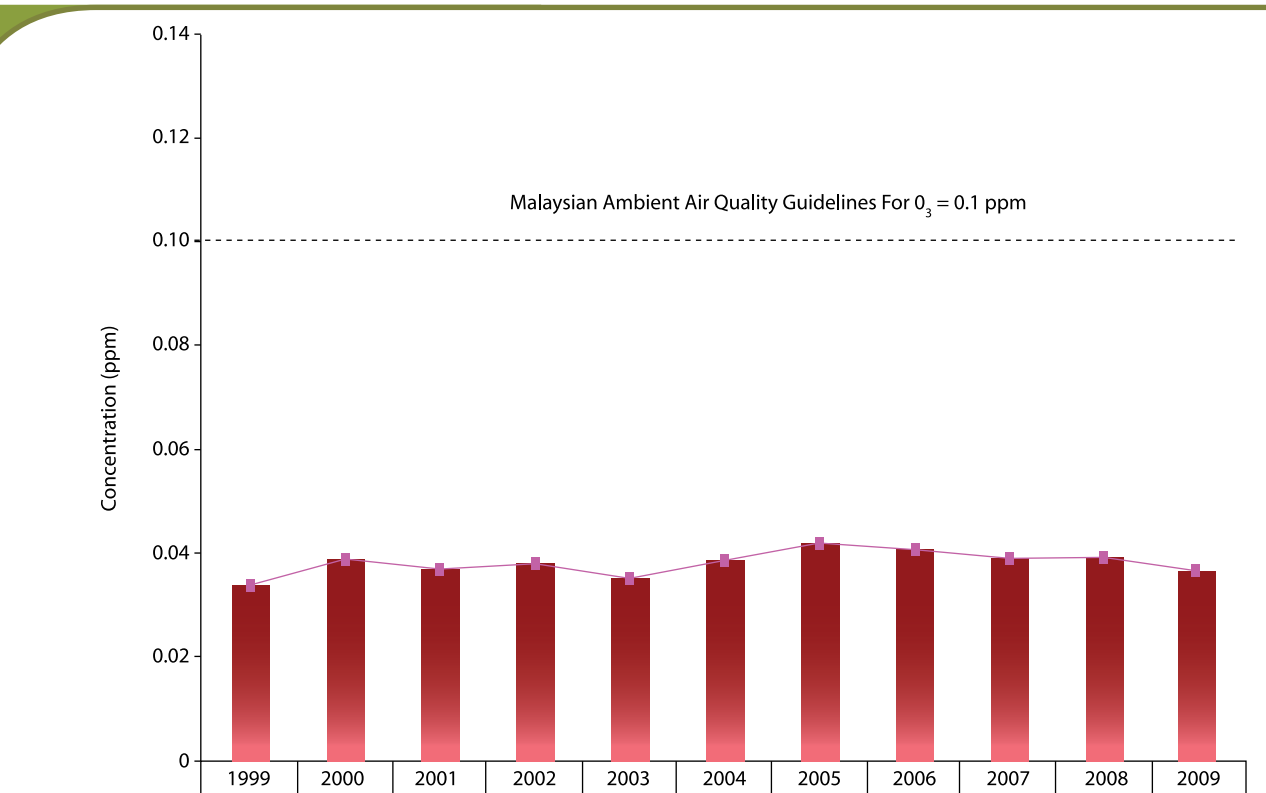
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Concentration	0.0074	0.0068	0.0073	0.0078	0.0078	0.0079	0.0095	0.0091	0.0089	0.0094	0.0073
Number of Sites	33	39	43	43	43	44	44	44	44	44	44

Figure 1.8 Malaysia: Annual Average Concentration of Nitrogen Dioxide (NO_2), 1999-2009



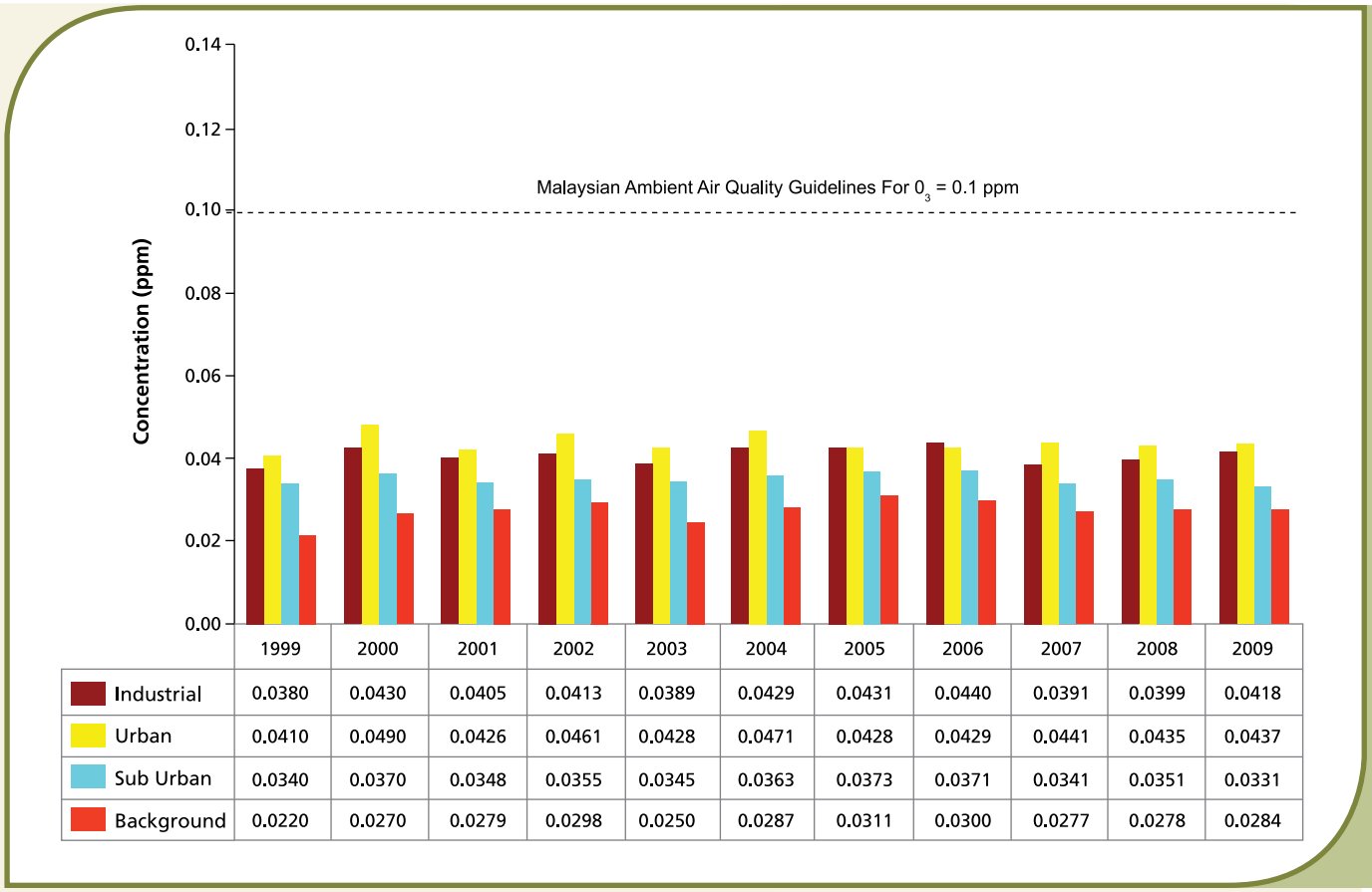
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Industrial	0.0096	0.0093	0.0105	0.0106	0.0104	0.0105	0.0105	0.0105	0.0103	0.0105	0.0100
Urban	0.0112	0.0104	0.0113	0.0122	0.0123	0.0122	0.0106	0.0105	0.0104	0.0115	0.0110
Sub Urban	0.0062	0.0062	0.0062	0.0065	0.0066	0.0068	0.0069	0.0066	0.0065	0.0066	0.0063
Background	0.0030	0.0014	0.0013	0.0018	0.0017	0.0020	0.0026	0.0020	0.0022	0.0020	0.0020

Figure 1.8(a) Malaysia : Annual Average Concentration of Nitrogen Dioxide (NO_2) by Land Use, 1999-2009



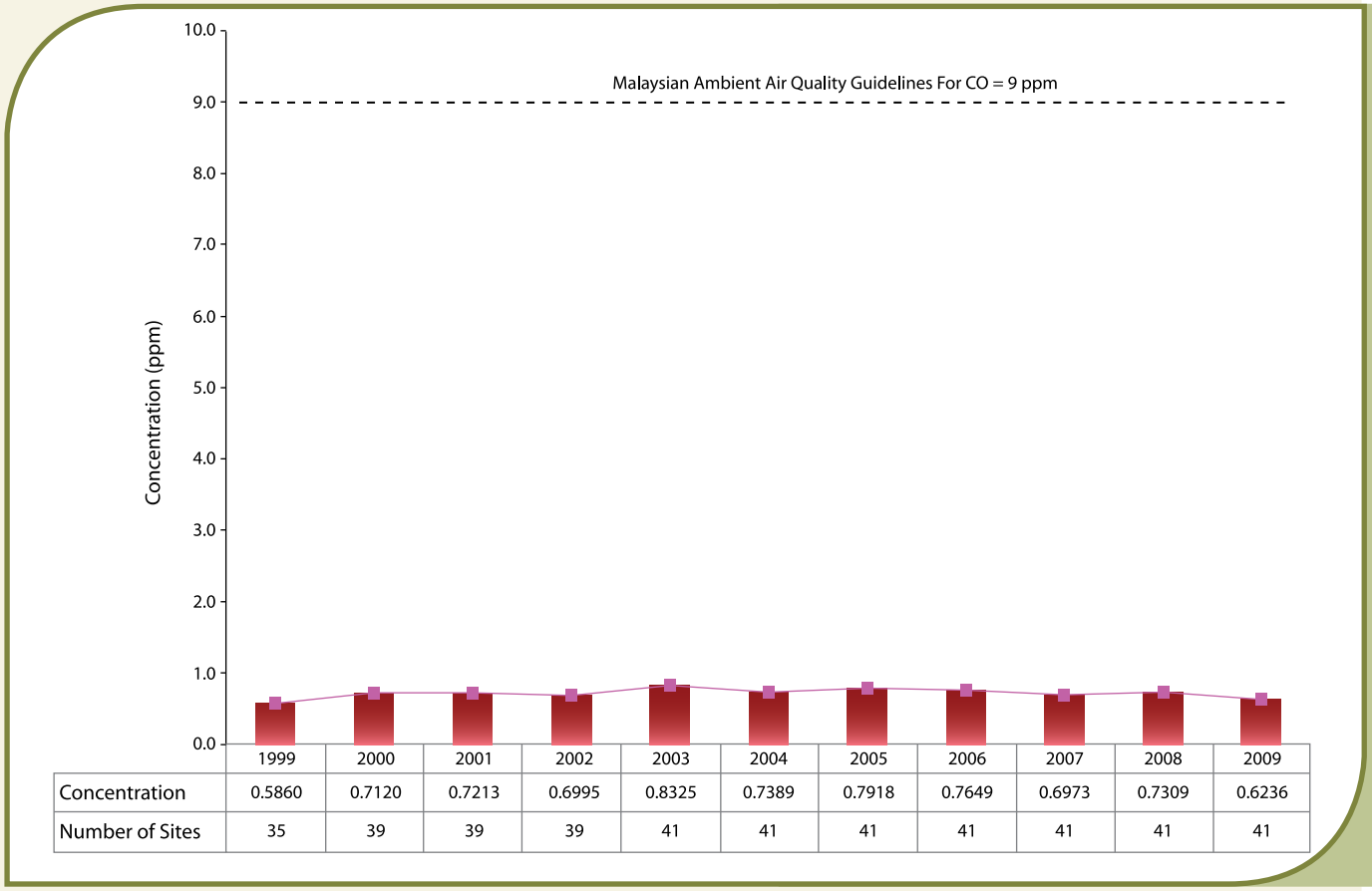
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Concentration	0.034	0.039	0.037	0.0382	0.0353	0.0388	0.0421	0.0408	0.039	0.0392	0.0368
Number of Sites	35	39	39	39	41	41	41	41	41	41	44

Figure 1.9 Malaysia : Annual Average Daily Maximum 1 Hour Concentration of Ozone (O_3), 1999-2009



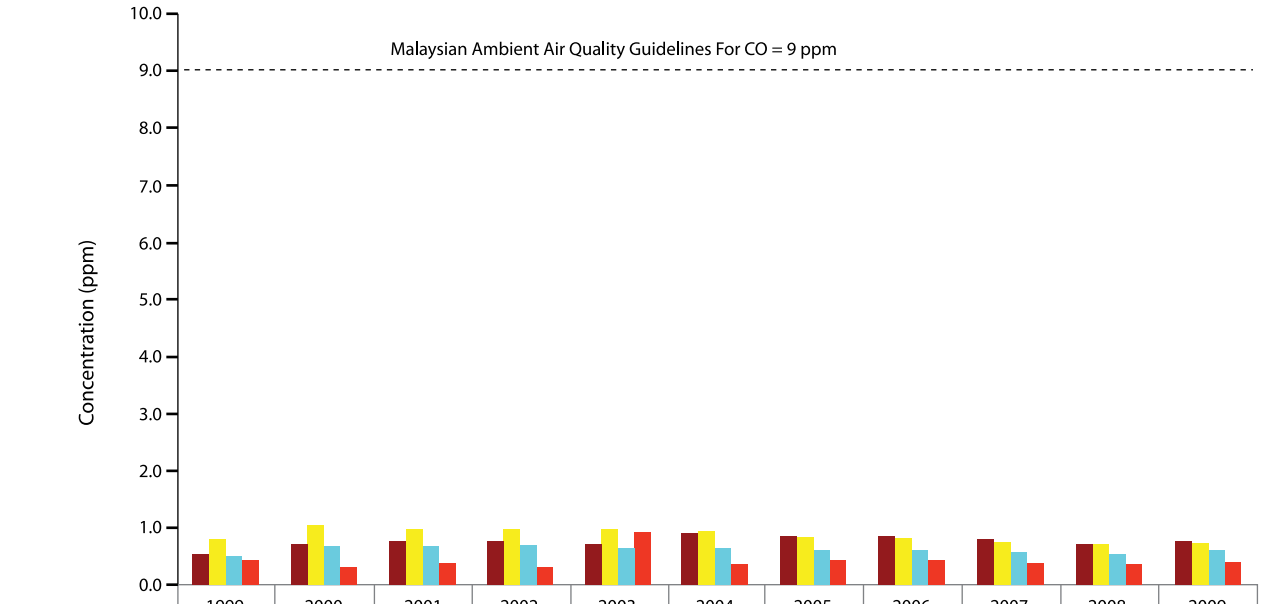
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Industrial	0.0380	0.0430	0.0405	0.0413	0.0389	0.0429	0.0431	0.0440	0.0391	0.0399	0.0418
Urban	0.0410	0.0490	0.0426	0.0461	0.0428	0.0471	0.0428	0.0429	0.0441	0.0435	0.0437
Sub Urban	0.0340	0.0370	0.0348	0.0355	0.0345	0.0363	0.0373	0.0371	0.0341	0.0351	0.0331
Background	0.0220	0.0270	0.0279	0.0298	0.0250	0.0287	0.0311	0.0300	0.0277	0.0278	0.0284

Figure 1.9(a) Malaysia : Annual Average Daily Maximum 1 Hour Concentration of Ozone (O_3) by Land Use, 1999-2009



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Concentration	0.5860	0.7120	0.7213	0.6995	0.8325	0.7389	0.7918	0.7649	0.6973	0.7309	0.6236
Number of Sites	35	39	39	39	41	41	41	41	41	41	41

Figure 1.10 Malaysia : Annual Average Concentration of Carbon Monoxide (CO), 1999-2009



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Industrial	0.5550	0.7390	0.7614	0.7676	0.7405	0.9442	0.8734	0.8830	0.7977	0.7537	0.7501
Urban	0.8220	1.0710	1.0091	0.9934	0.9981	0.9632	0.8636	0.8529	0.7635	0.7511	0.7288
Sub Urban	0.5200	0.6890	0.7169	0.7187	0.6768	0.6784	0.6335	0.6150	0.5766	0.5509	0.5775
Background	0.4480	0.3470	0.3978	0.3182	0.9145	0.3700	0.4582	0.4500	0.3924	0.3579	0.4379

Figure 1.10(a) Malaysia : Annual Average Concentration of Carbon Monoxide (CO) by Land Use, 1999-2009

A panoramic view of Jambu Bongkok Forest Reserve near Rantau Abang, Terengganu

Chapter 2: Noise Monitoring

Chapter 2: Noise Monitoring

NATIONAL AMBIENT NOISE MONITORING PROGRAMME

The Department of Environment (DOE) continues to monitor the ambient noise level more in 2009 at five (5) different types of receiving land use. They are in noise sensitive areas namely schools and hospitals, suburban residential areas (medium density), urban residential areas (high density and residential-commercial), commercial business zones and designated industrial zones. Traffic noise in areas that are planned for future development or redevelopment of existing roads were also measured. For monitoring purposes, 'a single 60 minutes sample' on noise level are measured in the morning, afternoon and evening.

Figure 2.1, Figure 2.2, Figure 2.3, Figure 2.4, Figure 2.5 and **Figure 2.6** show the L_{Aeq} noise levels recorded for selected areas in the various states. The data collected from this National Ambient Noise Monitoring Programme would be beneficial as a baseline data for planning purposes and new development in the future.

In 2009, most of the data collected exceeded the level specified in The Planning Guidelines for Environmental Noise Limits and Control, 2004. This could be attributed to insufficient buffer zone.

The Planning Guidelines for Environmental Noise Limits and Control 2004, specify maximum permissible noise levels for different category of receiving land use as shown in **Schedule 1 and 2** for any new development and **Schedule 3** for road traffic (for proposed new roads and/or redevelopment of existing roads).

Noise isolating barrier walls installed along the highway

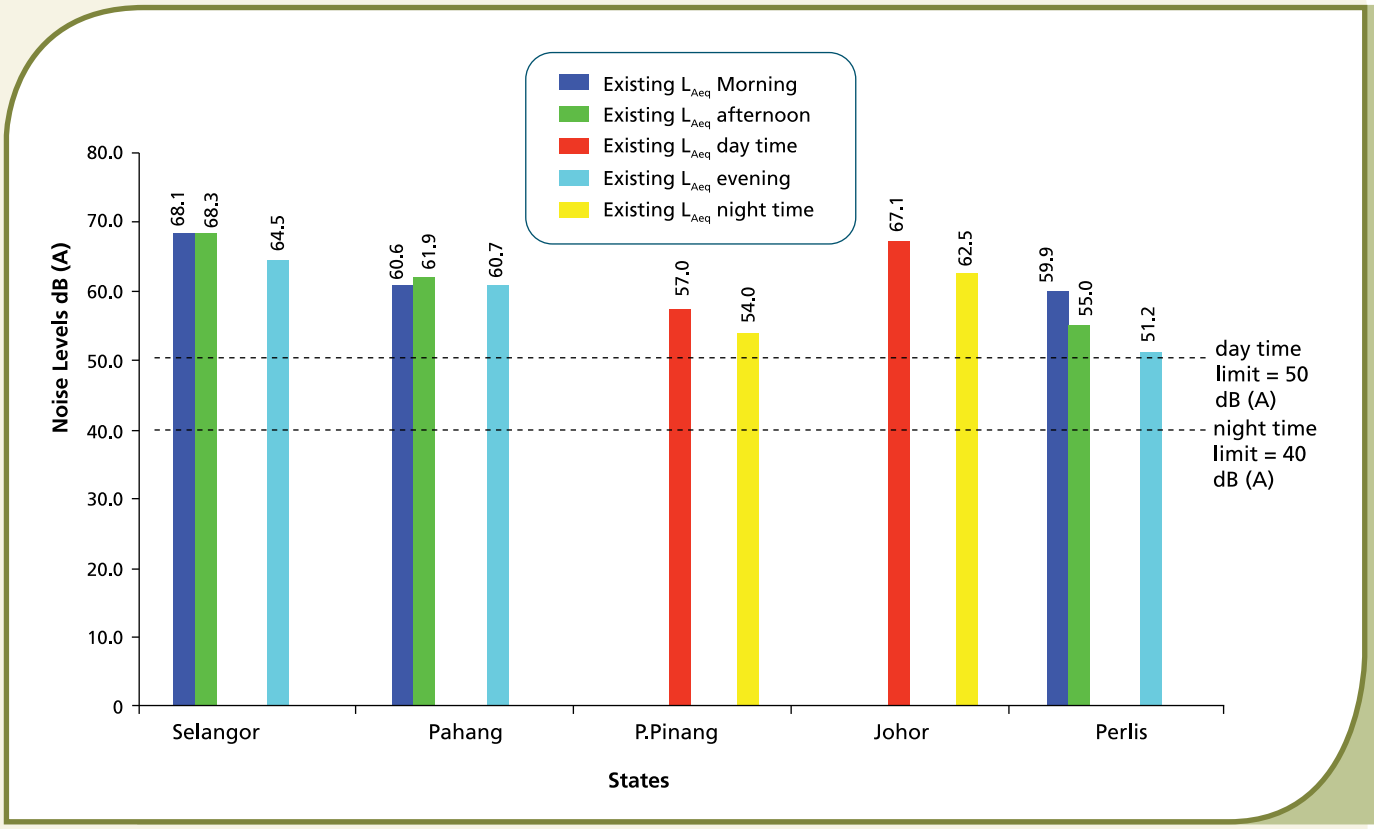


Figure 2.1 Malaysia : Noise Level for Selected Noise Sensitive Areas in various states

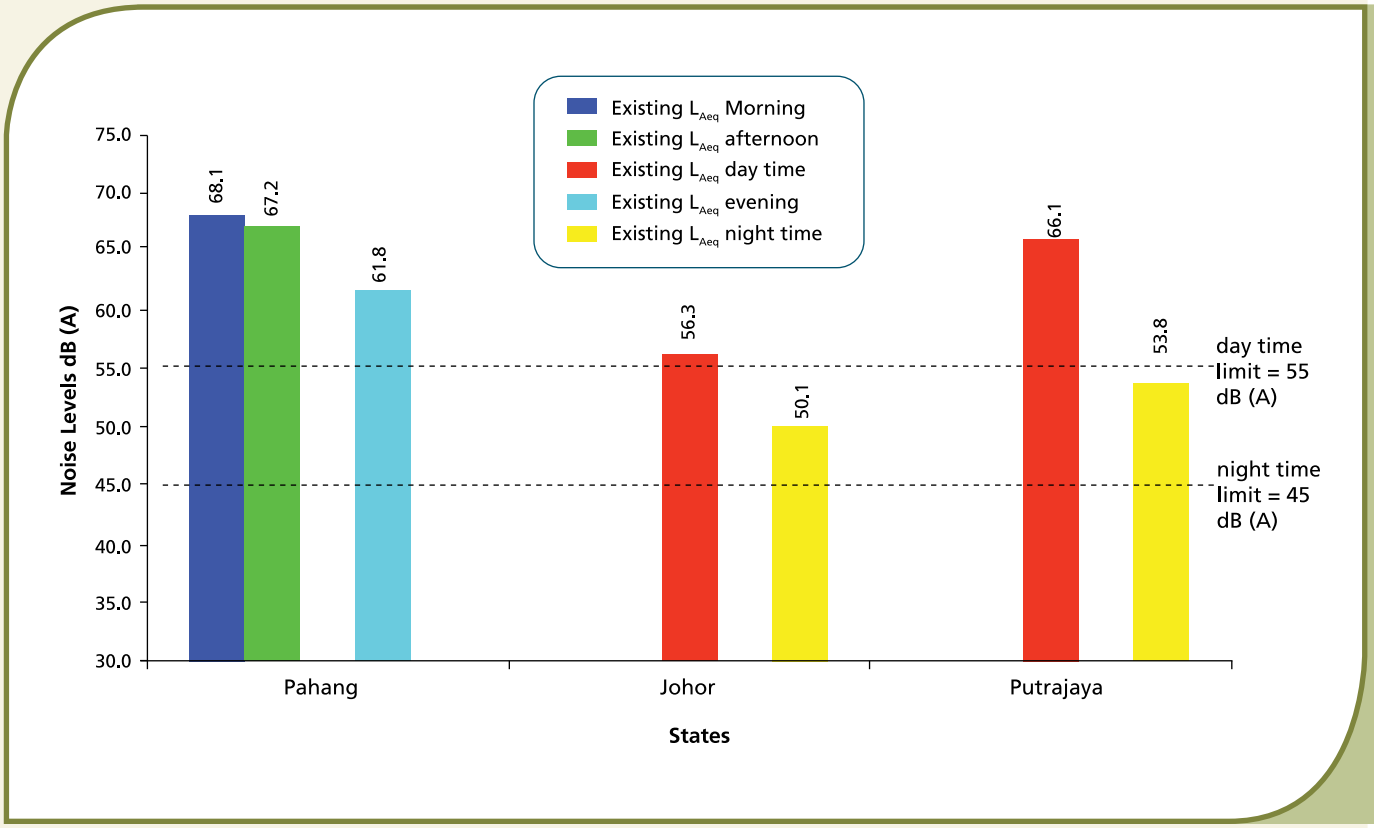


Figure 2.2 Malaysia : Noise Level for selected Sub Urban Residential Areas in various states

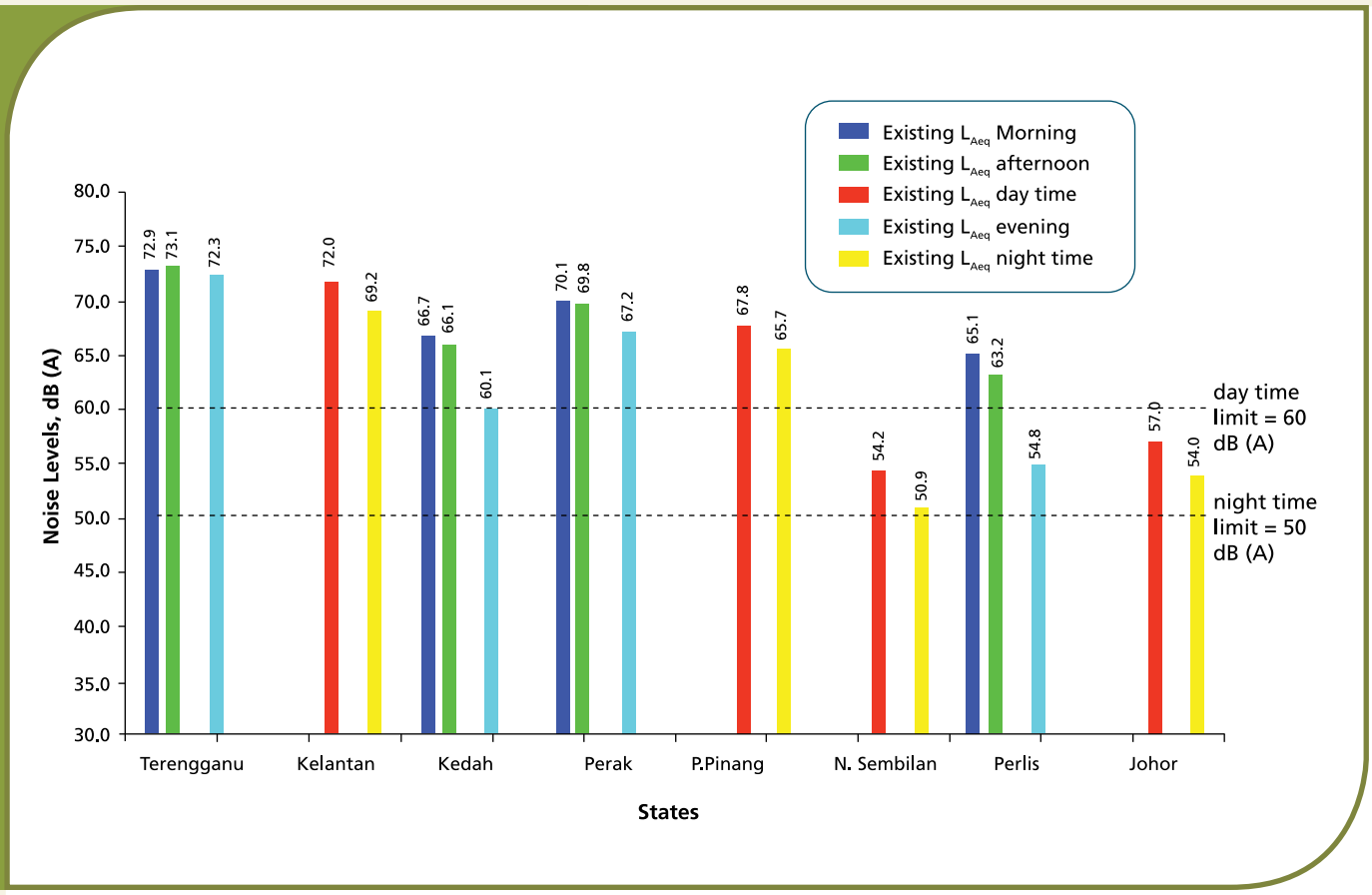


Figure 2.3 Malaysia : Noise Level for selected Urban Residential Areas in various states

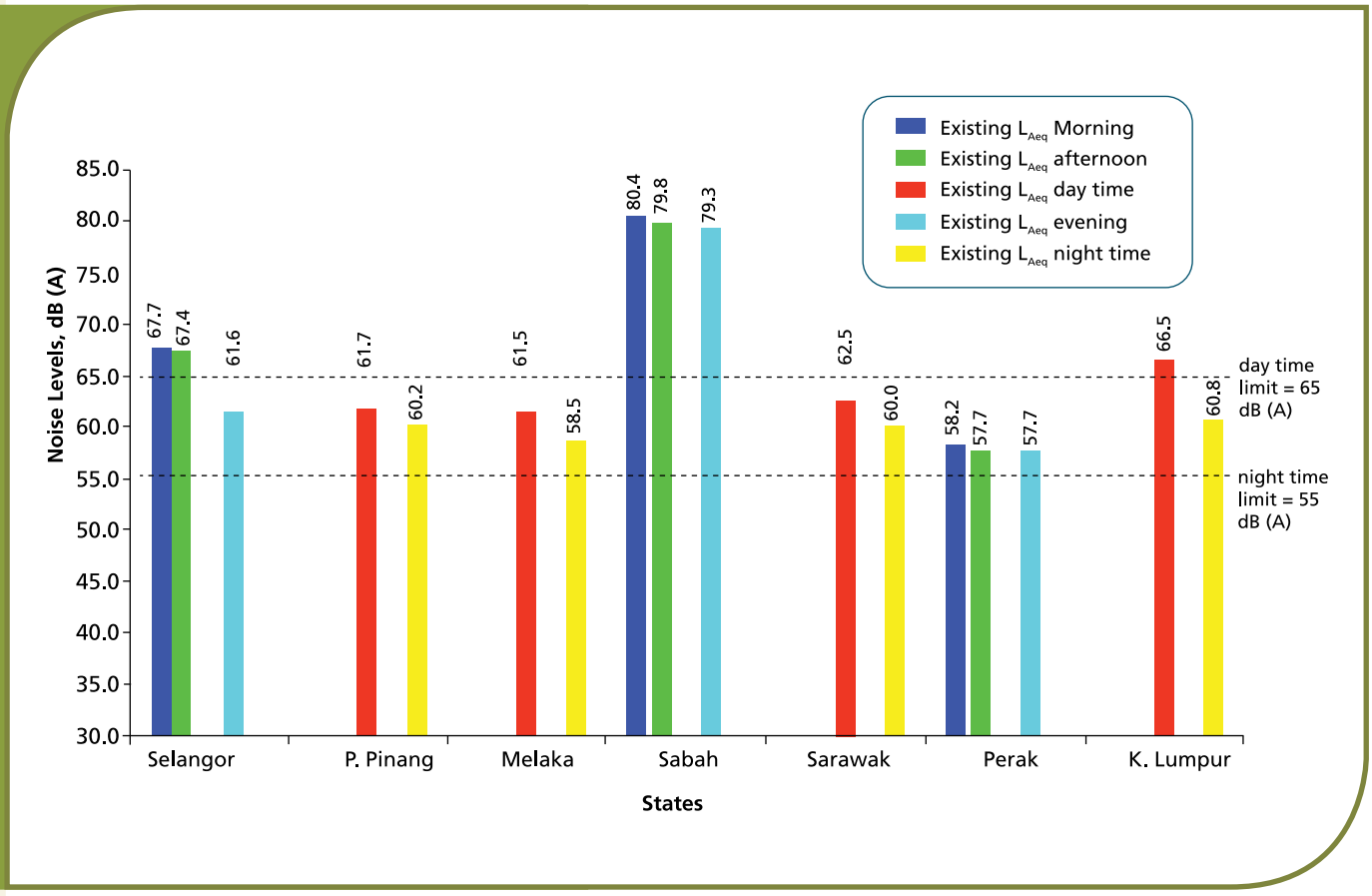


Figure 2.4 Malaysia : Noise Level for selected Commercial Business Zones in various states

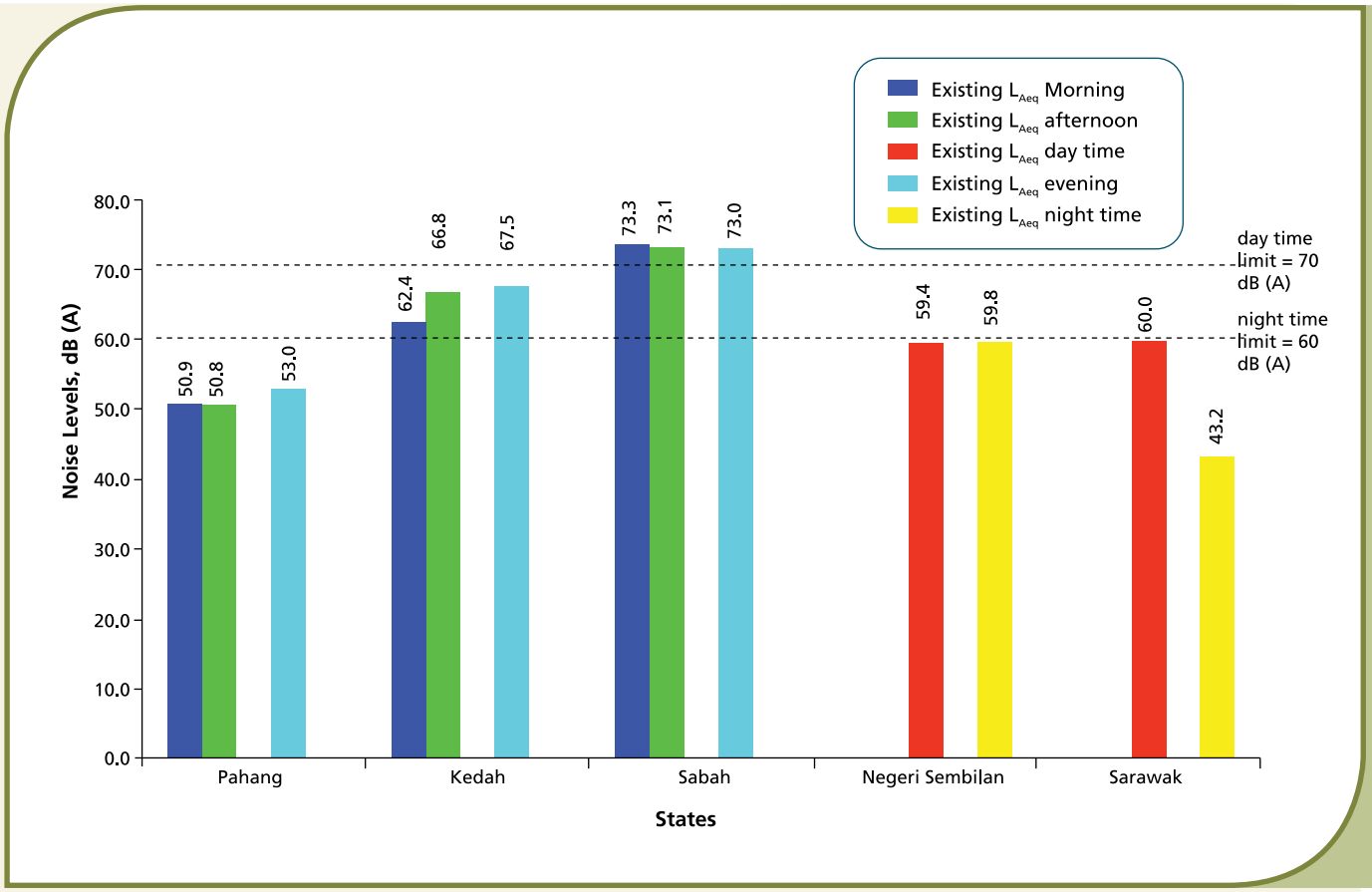


Figure 2.5 Malaysia : Noise Level for Selected Designated Industrial Zones in various states

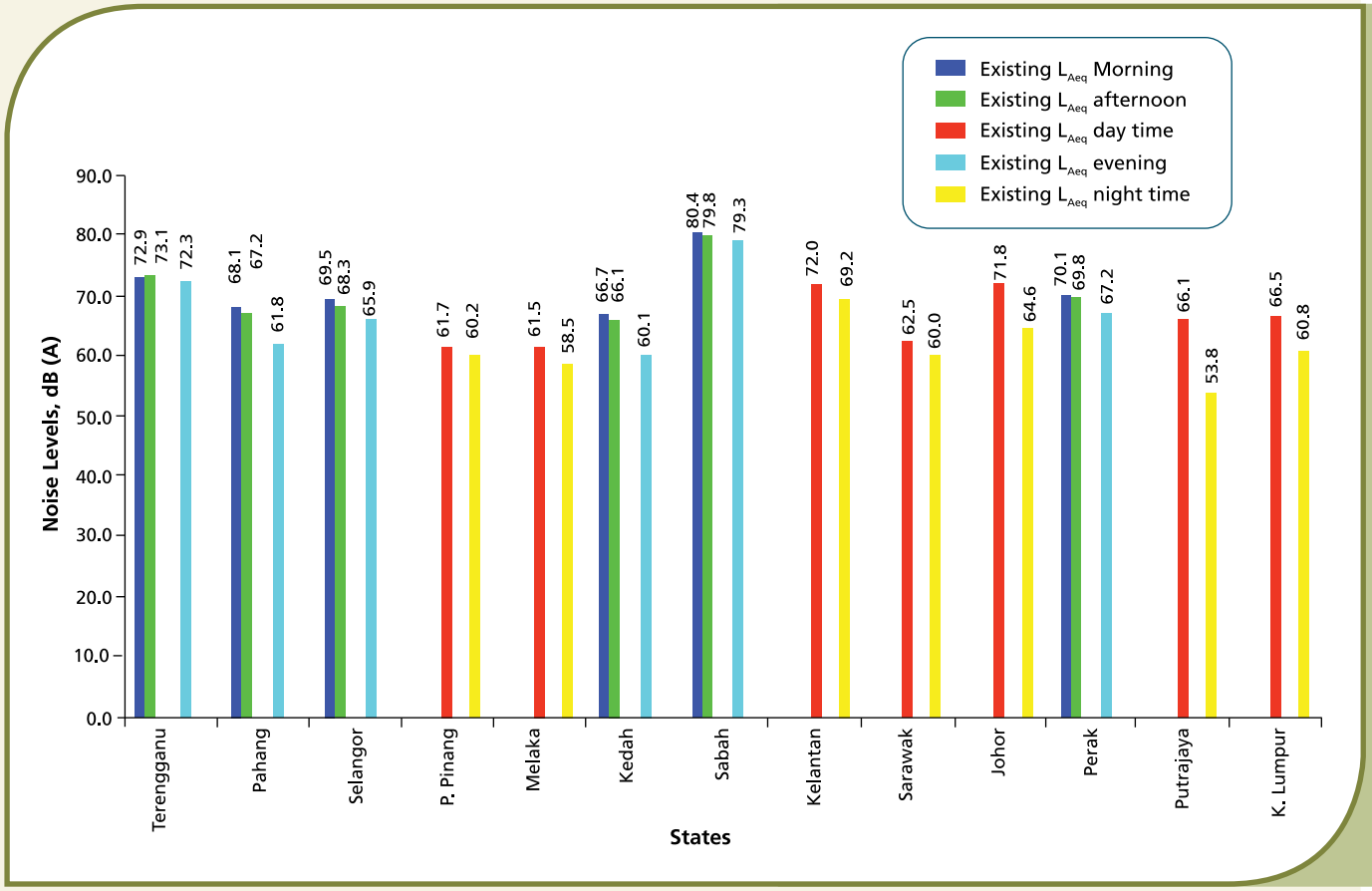


Figure 2.6 Malaysia : Noise Level due to traffic for selected areas in various states

Beautiful skyline of Kuala Lumpur

SCHEDULE 1
MAXIMUM PERMISSIBLE SOUND LEVEL (L_{Aeq}) OF RECEIVING LAND USE FOR PLANNING AND NEW DEVELOPMENT

Receiving Land Use Category	Day Time 7:00 a.m. – 10:00 p.m.	Night Time 10:00 p.m. – 7:00 a.m.
Noise Sensitive Areas, Low Density Residential, Institutional (School, Hospital) and Worship Areas	50 dBA	40 dBA
Suburban Residential (Medium Density) Areas, Public Spaces, Parks and Recreational Areas	55 dBA	45 dBA
Urban Residential (High Density) Areas and Designated Mixed Development Areas (Residential - Commercial)	60 dBA	50 dBA
Commercial Business Zones	65 dBA	55 dBA
Designated Industrial Zones	70 dBA	60 dBA

Source : The Planning Guidelines for Environmental Noise Limits and Control, 2004.

SCHEDULE 2
MAXIMUM PERMISSIBLE SOUND LEVEL (L_{Aeq}) OF NEW DEVELOPMENT (ROADS, RAILS AND INDUSTRIAL) IN AREAS OF EXISTING HIGH ENVIRONMENTAL NOISE CLIMATE

Receiving Land Use Category	Day Time 7:00 a.m. – 10:00 p.m.	Night Time 10:00 p.m. – 7:00 a.m.
Noise Sensitive Areas and Low Density Residential Areas	L_{90} + 10 dBA	L_{90} + 5 dBA
Suburban and Urban Residential Areas	L_{90} + 10 dBA	L_{90} + 5 dBA
Commercial and Business Areas	L_{90} + 10 dBA	L_{90} + 10 dBA
Industrial Areas	L_{90} + 10 dBA	L_{90} + 10 dBA

Source : The Planning Guidelines for Environmental Noise Limits and Control, 2004.
Note : L_{90} is the measured ninety percentile sound level for the respective time period of the existing areas of interest in the absence of the proposed new development.

SCHEDULE 3
LIMITING SOUND LEVEL (L_{Aeq}) FROM ROAD TRAFFIC (FOR PROPOSED NEW ROADS AND/OR REDEVELOPMENT OF EXISTING ROADS)

Receiving Land Use Category	Day Time 7:00 a.m. – 10:00 p.m.	Night Time 10:00 p.m. – 7:00 a.m.
Noise Sensitive Areas, Low Density Residential Areas.	55 dBA	50 dBA
Suburban Residential (Medium Density)	60 dBA	55 dBA
Urban Residential (High Density)	65 dBA	60 dBA
Commercial Business	70 dBA	60 dBA
Industrial Areas	75 dBA	65 dBA

Source : The Planning Guidelines for Environmental Noise Limits and Control, 2004.

Chapter 3: River Water Quality

Chapter 3: River Water Quality

RIVER WATER QUALITY MONITORING

The Department of Environment (DOE) continued with the river water quality monitoring programme in 2009 to detect changes in river water quality and to identify pollution sources. Water samples were collected at regular intervals from designated stations for in-situ and laboratory analysis to determine its physico-chemical and biological characteristics. The Water Quality Index (WQI) was used as a basis for assessment of a watercourse in relation to pollution load categorization and designation of classes of beneficial uses as stipulated in the National Water Quality Standards for Malaysia (NWQS)(ANNEX). The WQI was derived using Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammoniacal Nitrogen (NH_3-N), Suspended Solids (SS) and pH.

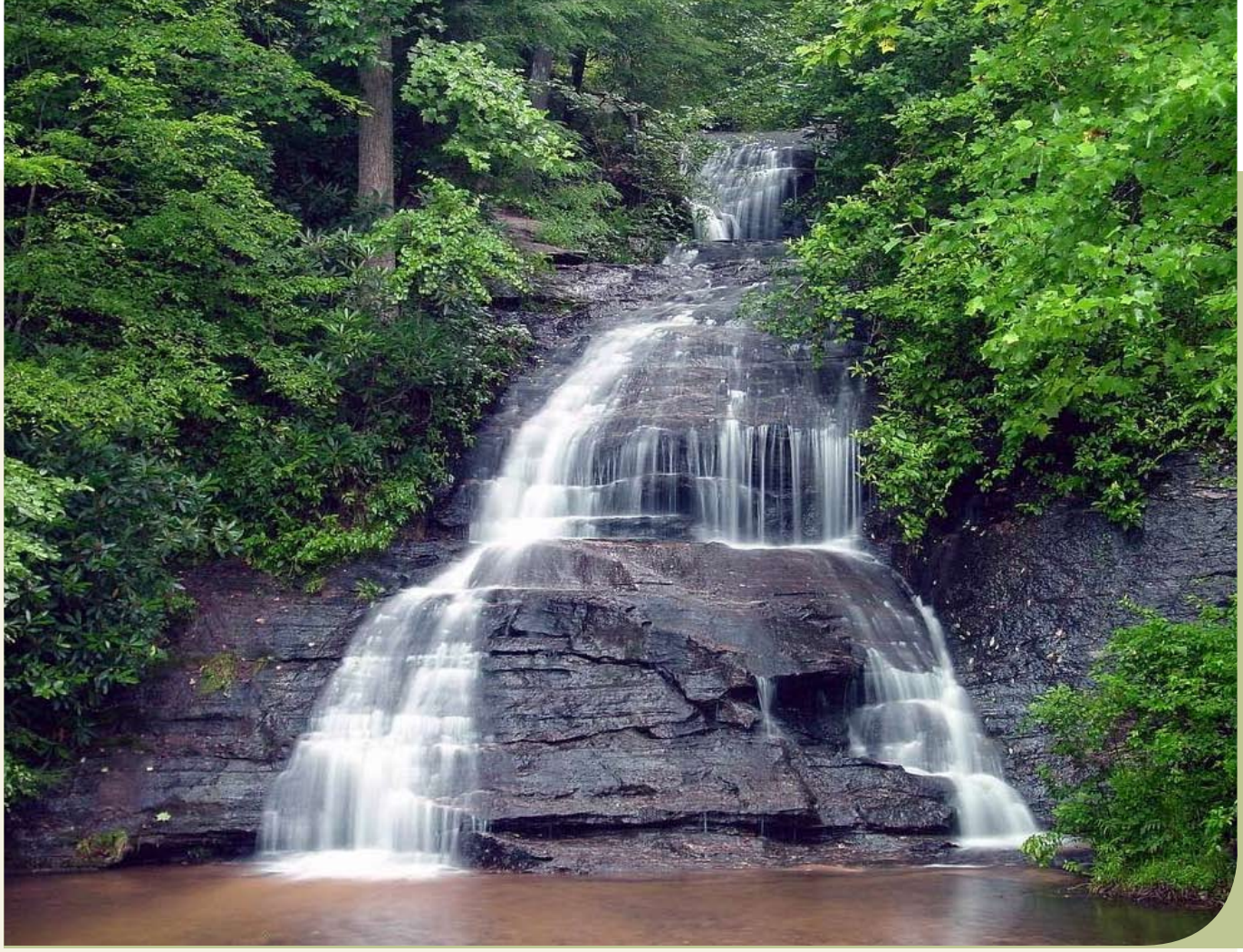
RIVER WATER QUALITY STATUS

In 2009, a total of 1,063 water quality monitoring stations located at 577 rivers were monitored. Out of these 1,063 monitoring stations, 578 (54%) were found to be clean, 378 (36%) slightly polluted and 107 (10%) polluted **(Tables 3.1, 3.2 and 3.3)**. The trend of the river water quality is shown in **Figure 3.1.** In 2009, there was a reduction in the number of clean rivers compared with 2008. There were 306 clean rivers in 2009 as compared with 334 in 2008 while the number of slightly polluted and polluted rivers increased from 197 to 217 and 48 to 54 respectively. The decrease in the number of clean rivers were attributed to an increase in the number of polluting sources such as sewage treatment plants, manufacturing industries and palm oil mills which contributed to a high pollution loading.

As in previous years, the major pollutants detected were BOD, NH_3-N and SS. High BOD can be attributed to untreated or partially treated sewage and discharges from agro-based and manufacturing industries. The main sources of NH_3-N were livestock farming and domestic sewage, whilst the sources for SS were earthworks and land clearing activities.

The DOE maintained 15 continuous water quality monitoring stations for early detection of pollution influx. For the period of January to December 2009, 34 incidences of distinctive pollution influx were observed as shown in **Table 3.4**.

Cumulative water quality data compiled from these 15 continuous water quality monitoring stations are presented in **Figures 3.2, 3.3, 3.4 and 3.5**. Based on the 90-percentile value, low DO levels were most frequent in Sungai Jinjang (41.0% saturation) followed by Sungai Putat (49.0% saturation) and Sungai Perai (54.0% saturation) **(Figure 3.2)**. High ammonium levels were recorded more frequently in Sungai Jinjang (17.0 mg/l) followed by Sungai Putat (12.0 mg/l) and Sungai Labu (5.8 mg/l) **(Figure 3.3)**. High turbidity level was most frequently detected at Sungai Rajang (1800 NTU), followed by Sungai Melaka (650 NTU) and Sungai Labu (600 NTU) **(Figure 3.4)**. Meanwhile pH value of 6.4 was recorded at Sungai Selangor, pH 6.5 at Sungai Terengganu and pH 6.6 at Sungai Perai **(Figure 3.5)**.



Picturesque view of a cascading waterfall amidst greenery

RIVER WATER POLLUTION SOURCES

Figures 3.6, 3.7 and 3.8 show the status of river water quality in terms of BOD, NH_3-N and SS. Based on BOD level, 152 rivers were categorized as polluted, 238 rivers as slightly polluted and 187 rivers as clean **(Figure 3.6)**. Based on NH_3-N, 183 rivers were categorized as polluted, 167 rivers as slightly polluted and 227 rivers as clean **(Figure 3.7)**. Meanwhile, 186 rivers were categorized as polluted by SS, 100 rivers as slightly polluted and 291 rivers as clean **(Figure 3.8)**.

Water samples were also analysed for heavy metals. From the 5,637 water samples analysed almost all samples complied with Class III of the National Water Quality Standards for arsenic (As), mercury (Hg), cadmium (Cd), chromium (Cr), lead (Pb) and zinc (Zn), except iron (Fe) where the compliance was 97 percent.

RIVER WATER STUDIES

River Pollution Prevention and Water Quality Improvement Programme had been implemented since the year 2001 under the 8th Malaysian Plan and continued in the 9th Malaysian Plan. Under this programme a number of detailed river studies have been carried out to determine the pollution sources and formulation of action plans. The river basins studied were Sungai Langat (Selangor), Sungai Segget/Tebrau (Johor), Sungai Melaka (Melaka), Batang Rajang (Sarawak), Rivers in Cameron Highlands (Pahang), Sungai Linggi (Negeri Sembilan), Sungai Sepetang (Perak) and Sungai Merbok (Kedah).

In 2009, the detailed study for Sungai Kinabatangan (Sabah) was completed while studies for Sungai Kuantan dan Sungai Sarawak are currently on-going and expected to be completed in mid-2010.

Table 3.1 Malaysia : Water Quality Status of Clean Rivers, 2009

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
PERLIS	PERLIS	JARUM	1	83	83	II	C
		JERNIH	2	87	81	II	C
		PELARIT	1	92	90	II	C
		WANG KELIAN	1	93	92	II	C
KEDAH	MERBOK	BUKIT MERAH	1	83	90	II	C
		TOK PAWANG	2	87	92	II	C
		TUPAH	2	94	95	I	C
	KISAP	KISAP	1	93	93	I	C
	ULU MELAKA	PETANG	1	93	92	II	C
		ULU MELAKA	1	88	86	II	C
	KEDAH	JANING	1	93	94	I	C
		PDG TERAP	4	85	86	II	C
		PEDU	1	90	90	II	C
		TEKAI	1	87	88	II	C
KEDAH/ P.PINANG	MUDA	CHEPIR	1	86	88	II	C
		KARANGAN	1	85	88	II	C
		KETIL	2	86	87	II	C
		MUDA	4	87	87	II	C
		PEGANG	1	93	93	I	C
		SEDIM	1	85	86	II	C
		TAWAR	1	88	90	II	C
P.PINANG	PINANG	AIR TERJUN	1	95	94	I	C
	KLUANG	ARA	2	80	84	II	C
	PERAI	KULIM	4	82	87	II	C
P.PINANG/ PERAK	KERIAN	KECHIL	2	79	83	II	C
		KERIAN	4	79	81	II	C
PERAK	PERAK	BATANG PADANG	3	84	85	II	C
		BIDOR	3	84	83	II	C
		CHEPOR	1	93	96	I	C
		CUAR	1	93	92	II	C
		KAMPAR	2	91	87	II	C
		KANGSAR	2	85	87	II	C
		KINJANG	1	94	90	II	C
		KUANG	1	83	84	II	C
		PELUS	2	89	88	II	C
		PERAK	8	86	89	II	C
		RAIA	2	90	87	II	C
		SUNGKAI	2	87	84	II	C
	RAJA HITAM	MANJONG	2	82	85	II	C
		NYIOR	1	93	93	I	C
	KURAU	ARA	2	90	94	I	C
	SEPETANG	BATU TEGOH	3	86	87	II	C
		JANA	2	86	87	II	C
		LIMAU	1	91	87	II	C
		TEMERLOH	2	92	91	II	C
		TRONG	1	90	92	II	C
		TUPAI	1	86	84	II	C
	BRUAS	BRUAS	3	82	87	II	C

Table 3.1 Malaysia : Water Quality Status of Clean Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
PERAK		DANDANG	1	82	86	II	C
		ROTAN	2	89	93	I	C
PERAK/ SELANGOR	BERNAM	INKI	1	93	93	I	C
		SLIM	3	88	90	II	C
		TROLAK	2	91	93	I	C
SELANGOR	LANGAT	CHUAU	2	89	91	II	C
		LUI	1	92	91	II	C
	SELANGOR	BATANG KALI	1	91	91	II	C
		KANCHING	1	91	93	I	C
		KERLING	1	91	94	I	C
		SELANGOR	5	86	83	II	C
		SERENDAH	1	88	86	II	C
SELANGOR/ WPKL	KLANG	GOMBAK	3	82	82	II	C
		SEMELAH	1	83	86	II	C
N.SEMBILAN	LINGGI	BATANG PENAR	3	86	82	II	C
		CHEMBONG	1	85	81	II	C
		KUNDUR BESAR	1	85	84	II	C
		REMBAU	2	84	88	II	C
		SIPUT	2	86	84	II	C
MELAKA	MELAKA	BTG.MELAKA	2	86	82	II	C
		DURIAN TUNGGAL	1	85	83	II	C
		KEMUNTING	1	81	88	II	C
		KERU	1	88	88	II	C
		TAMPIN	3	84	87	II	C
	KESANG	CHOHONG	2	90	92	II	C
		KESANG	3	83	86	II	C
	DUYONG	GAPAM	1	93	92	II	C
JOHOR/ N.SEMBILAN	MUAR	AIR PANAS	1	92	94	I	C
		JUASSEH	2	87	89	II	C
		MEDA	1	86	83	II	C
		P. MENKUANG	1	83	83	II	C
		SEGAMAT	1	85	81	II	C
JOHOR	BATU PAHAT	BANTANG	1	93	96	I	C
		CHAAH	1	85	91	II	C
		LENIK	1	86	87	II	C
		MEREK	1	87	88	II	C
	BENUT	ULU BENUT	1	79	83	II	C
	ENDAU	ANK SG.SEMBERONG	1	84	83	II	C
		ENDAU	3	87	90	II	C
		JASIN	1	94	96	I	C
		KAHANG	1	85	87	II	C
		LENGGOR	1	82	84	II	C
		MAMAI	1	84	86	II	C
		PALOH	1	85	86	II	C
		SELAI	1	90	94	I	C
		SEMBERONG	5	84	83	II	C
		SINGOL	1	86	84	II	C
		TAMOK	1	88	92	II	C

Table 3.1 Malaysia : Water Quality Status of Clean Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
JOHOR	JOHOR	ANAK SG. SAYONG	2	85	83	II	C
		BELITONG	1	87	89	II	C
		BUKIT BESAR	2	88	87	II	C
		CHEMANGAR	1	79	82	II	C
		JOHOR	4	85	85	II	C
		LAYANG	1	90	92	II	C
		LAYAU KIRI	1	90	87	II	C
		LINGGIU	1	88	90	II	C
		PANTI	1	86	83	II	C
		PAPAN	1	87	89	II	C
		PELEPAH	2	91	93	I	C
		PENGGELI	2	88	91	II	C
		REMIS	1	85	86	II	C
		SANTI	1	82	83	II	C
		SAYONG	4	85	88	II	C
		SELUYUT	1	85	82	II	C
		SEMANGAR	1	88	88	II	C
		SENING	1	79	91	II	C
		TELOR	1	87	92	II	C
		TEMOH	1	89	91	II	C
	SEDILI BESAR	AMBAT	1	84	87	II	C
		DOHOL	1	87	86	II	C
		SEDILI BESAR	5	81	83	II	C
		TEMUBOR KANAN	1	87	89	II	C
	SEDILI KECIL	ANAK SEDILI KECIL	1	78	81	II	C
		BAHAN	2	82	85	II	C
		SEDILI KECIL	3	81	84	II	C
	PALOI	PALOI	1	87	86	II	C
	MERSING	MERSING	2	87	87	II	C
PAHANG	ANAK ENDAU	ANAK ENDAU	2	87	84	II	C
	ROMPIN	AUR	1	89	89	II	C
		JEKATIH	2	87	85	II	C
		JERAM	1	91	92	II	C
		KEPASING	1	88	89	II	C
		KERATONG	3	86	82	II	C
		PONTIAN	1	90	90	II	C
		PUKIN	3	88	87	II	C
		ROMPIN	4	85	84	II	C
	MERCHONG	MERCHONG	2	86	84	II	C
	PAHANG	BELAYAR	1	92	92	II	C
		BENTONG	4	89	90	II	C
		BENUS	2	92	93	I	C
		BERA	3	85	83	II	C
		BERKAPOR	1	89	91	II	C
		BERTAM	3	81	82	II	C
		BILUT	1	87	87	II	C
		BURUNG	1	93	96	I	C
		CHINI	1	85	82	II	C

Table 3.1 Malaysia : Water Quality Status of Clean Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
PAHANG		HABU	1	89	92	II	C
		JELAI	2	87	88	II	C
		JEMPOL	2	87	91	II	C
		JENGKA	2	84	83	II	C
		KELAU	2	88	90	II	C
		KERTAM	1	84	88	II	C
		KOYAN	1	89	89	II	C
		LENGGOK	1	90	88	II	C
		LEPAR	3	86	88	II	C
		LIPIS	3	89	90	II	C
		LUIT	1	89	90	II	C
		MARAN	1	81	89	II	C
		MENTIGA	2	86	86	II	C
		PAHANG	8	85	87	II	C
		PENJURING	1	93	94	I	C
		PERTANG	2	86	83	II	C
		PERTING	1	93	92	II	C
		RINGLET	1	85	82	II	C
		SEMANTAN	3	83	85	II	C
		T. PAYA BUNGOR	1	87	91	II	C
		TAHAN	1	91	88	II	C
		TANGLIR	1	89	92	II	C
		TASIK BERA	1	87	84	II	C
		TASIK CHINI	10	86	90	II	C
		TEKAL	1	83	83	II	C
		TEKAM	2	84	86	II	C
		TELANG	1	90	88	II	C
		TELEMONG	1	91	94	I	C
		TELOM	2	88	91	II	C
		TEMBELING	1	91	91	II	C
		TERANUM	1	85	93	I	C
		TERAS	1	88	91	II	C
		TERLA	1	93	95	I	C
		TRIANG	2	86	87	II	C
		TRINGKAP	1	85	85	II	C
	KUANTAN	BELAT	1	85	84	II	C
		CHARU	1	88	88	II	C
		KENAU	1	90	93	I	C
		KUANTAN	5	87	89	II	C
		PANDAN	1	87	88	II	C
	BEBAR	MERBA	1	82	81	II	C
TERENGGANU	CHUKAI	CHUKAI	1	88	86	II	C
		IBOK	2	85	87	II	C
	KEMAMAN	CHERUL	2	84	89	II	C
		KEMAMAN	3	85	88	II	C
		PERASING	1	85	87	II	C
	KERTIH	KERTIH	2	85	86	II	C
	PAKA	BESUL	1	87	90	II	C

Table 3.1 Malaysia : Water Quality Status of Clean Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
TERENGGANU		PAKA	2	83	81	II	C
		RASAU	2	87	84	II	C
	DUNGUN	DUNGUN	4	88	87	II	C
		TELEMBOH	1	85	84	II	C
	MARANG	KERAK	1	82	85	II	C
		MARANG	1	86	88	II	C
		TEMALA	1	89	88	II	C
	TERENGGANU	BERANG	2	92	94	I	C
		PUEH	2	90	91	II	C
		TELEMONG	1	87	87	II	C
		TERENGGANU	3	86	85	II	C
	SETIU	CHALOK	2	71	87	II	C
		SETIU	2	85	91	II	C
		TAROM	1	90	82	II	C
	BESUT	BESUT	3	91	90	II	C
	KLUANG	KLUANG	1	87	85	II	C
KELANTAN	KEMASIN	SEMERAK	3	85	83	II	C
		ARING	1	85	90	II	C
		BELATOP	2	80	82	II	C
		BER	1	92	93	I	C
		BEROK	3	85	89	II	C
		BETIS	1	90	94	I	C
		CHIKU	1	89	83	II	C
		GALAS	5	87	90	II	C
		KELANTAN	3	85	85	II	C
		KELESA	1	88	91	II	C
		KERILLA	2	93	95	I	C
		KETIL	1	86	93	I	C
		LEBIR	4	86	88	II	C
		NAL	3	90	89	II	C
		NENGGIRI	3	85	90	II	C
		PEHI	1	87	88	II	C
		PERGAU	6	91	93	I	C
		RELAI	2	86	92	II	C
		SOKOR	1	86	86	II	C
		TUANG	1	89	94	I	C
	GOLOK	GOLOK	5	89	91	II	C
		LANAS	1	92	89	II	C
	PENGKALAN DATU	PENGKALAN DATU	3	79	83	II	C
SARAWAK	SARAWAK	KUAP	2	81	82	II	C
		SARAWAK	6	86	85	II	C
		SARAWAK KANAN	1	78	86	II	C
		SEMADANG	1	90	96	I	C
		TABUAN	1	68	81	II	C
	SIMILAJAU	SIMILAJAU	2	84	86	II	C
	LIMBANG	LIMBANG	5	81	87	II	C
	TRUSAN	TRUSAN	1	88	87	II	C
	LAWAS	LAWAS	3	90	86	II	C

Table 3.1 Malaysia : Water Quality Status of Clean Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
SARAWAK	LUPAR	AI	2	87	91	II	C
		SEKERANG	1	79	89	II	C
		SETERAP	1	77	82	II	C
		UNDUP	1	85	82	II	C
	RAJANG	BALOI	1	81	81	II	C
		BINATANG	1	89	88	II	C
		JULAU	1	87	86	II	C
		KANOWIT	1	86	86	II	C
	OYA	OYA	3	78	83	II	C
	TATAU	TATAU	1	79	83	II	C
	SADONG	TARAT	1	88	88	II	C
	SIBUTI	KEJAPIL	1	84	83	II	C
	MIRI	PADANG LIKU	1	87	87	II	C
SABAH	LIKAS	INANAM	3	84	83	II	C
		MENGGATAL	2	91	87	II	C
	KINABATANGAN	KARAMUAK	1	85	92	II	C
		KOYAH	1	84	84	II	C
	KALUMPANG	KALUMPANG	3	88	85	II	C
	MENGGALONG	MENGGALONG	2	90	89	II	C
	LAKUTAN	LAKUTAN	1	91	90	II	C
	LINGKUNGAN	BUKAU	1	89	88	II	C
		LINGKUNGAN	1	93	91	II	C
	PADAS	BUNSIT	1	91	96	I	C
		LIAWAN	1	90	96	I	C
		PANGATAN	1	85	88	II	C
		PEGALAN	3	87	89	II	C
		TANDULU	1	92	96	I	C
	MEMBAKUT	MEMBAKUT	1	86	83	II	C
	KIMANIS	KIMANIS	1	86	86	II	C
	BONGAWAN	BONGAWAN	1	86	85	II	C
	PAPAR	PAPAR	3	89	90	II	C
	MOYOG	MOYOG	4	91	91	II	C
	TUARAN	DAMIT	2	85	90	II	C
		SONG SAI	1	88	92	II	C
		TUARAN	2	91	92	II	C
	KEDAMAIAN	KEDAMAIAN	1	93	95	I	C
		TEMPASUK	2	92	92	II	C
		WARIU	1	92	94	I	C
	TENGHILAN	TENGHILAN	1	90	91	II	C
	BINGKONGAN	BANDAU	1	92	94	I	C
		BINGKONGAN	2	92	93	I	C
		MENGGARIS	2	92	92	II	C
		TANDEK	1	88	88	II	C
	BENGKOKA	BENGKOKA	2	84	89	II	C
	PAITAN	PAITAN	1	87	88	II	C
	SUGUT	BONGKUD	1	93	96	I	C
		LOHAN	1	91	94	I	C
		MERALI	1	93	95	I	C

Table 3.1 Malaysia : Water Quality Status of Clean Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
SABAH		SUGUT	3	91	92	II	C
	LABOK	KINIPIR	2	89	91	II	C
		LABOK	1	86	90	II	C
		LIWAGU	2	87	88	II	C
		MALIAU	1	93	95	I	C
		TUNGUD	1	88	89	II	C
	SAPI	SAPI	3	81	82	II	C
		SUALONG	1	92	92	II	C
	MOUNAD	MOUNAD	2	83	86	II	C
	TUNGKU	TUNGKU	2	88	85	II	C
	SILABUKAN	SILABUKAN	2	81	85	II	C
	TINGKAYU	TINGKAYU	2	84	83	II	C
	TAWAU	TAWAU	4	88	86	II	C
	APAS	APAS	1	86	89	II	C
	BALUNG	BALUNG	1	87	86	II	C
	MEROTAI	MEROTAI	3	88	87	II	C
	BRANTIAN	BRANTIAN	1	84	86	II	C
	TELIPOK	TELIPOK	2	80	82	II	C

Table 3.2 Malaysia : Water Quality Status of Slightly Polluted Rivers, 2009

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
PERLIS	PERLIS	KOK MAK	1	73	70	III	SP
		NGULANG	1	76	75	III	SP
		PERLIS	1	71	72	III	SP
		SERAI	1	78	75	III	SP
KEDAH	KEDAH	KEDAH	1	71	65	III	SP
		PENDANG	1	78	80	II	SP
	KUAH	KUAH	1	82	73	III	SP
	MERBOK	BAKAR ARANG	1	69	68	III	SP
		BONGKOK	1	67	75	III	SP
		MERBOK	1	73	76	III	SP
KEDAH/ P.PINANG	MUDA	JERUNG	2	72	74	III	SP
P.PINANG	PINANG	AIR ITAM	5	59	64	III	SP
		PINANG	1	61	64	III	SP
	JURU	JURU	2	53	60	III	SP
		KILANG UBI	5	69	70	III	SP
		PASIR	1	60	63	III	SP
		PMTG RAWA	1	62	69	III	SP
	KLUANG	KLUANG	1	62	65	III	SP
		RELAU	1	66	73	III	SP
	PERAI	JARAK	5	72	74	III	SP
		KELADI	1	78	80	II	SP
		KUBANG SEMANG	1	62	63	III	SP
		PERAI	2	65	65	III	SP
		PERTAMA	1	57	61	III	SP
		SELUANG BAWAH	2	57	60	III	SP
	BAYAN LEPAS	BAYAN LEPAS	1	61	69	III	SP
		TIRAM	2	70	69	III	SP
	JAWI	JUNJONG	3	73	69	III	SP
		MACHANG BUBOK	1	77	76	III	SP
P.PINANG/ PERAK	KERIAN	SELAMA	2	72	74	III	SP
		SERDANG	1	69	71	III	SP
PERAK	RAJA HITAM	DERHAKA	2	64	66	III	SP
		RAJA HITAM	3	72	73	III	SP
	KURAU	KURAU	4	79	80	II	SP
	SEPETANG	LARUT	1	75	79	II	SP
		MALAI	1	67	60	III	SP
		SEPETANG	2	77	77	II	SP
	WANGI	DERALIK	2	69	62	III	SP
		WANGI	2	77	70	III	SP
	PERAK	CHENDERIANG	2	84	79	II	SP
		KEPAYANG	2	67	73	III	SP
		KERDAH	2	74	70	III	SP
		KINTA	8	77	76	III	SP
		KLAH	2	85	79	II	SP
		KLIAN BARU	2	76	74	III	SP
		NYAMOK	1	72	73	III	SP
		PARI	2	71	70	III	SP

Table 3.2 Malaysia : Water Quality Status of Slightly Polluted Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
PERAK		PINJI	2	69	70	III	SP
		SEROKAI	2	64	71	III	SP
		SINTANG	1	61	70	III	SP
		SUNGKAI MATI	2	81	61	III	SP
		TUMBOH	1	74	72	III	SP
PERAK/ SELANGOR	BERNAM	BERNAM	7	81	78	II	SP
SELANGOR	LANGAT	ANAK CHUAU	1	78	75	III	SP
		BALAK	1	61	62	III	SP
		BATANG BENAR	2	66	69	III	SP
		BATANG LABU	2	78	72	III	SP
		BERANANG	1	84	78	II	SP
		BUAN	1	77	76	III	SP
		JIJAN	1	87	77	II	SP
		LANGAT	8	73	71	III	SP
		LIMAU MANIS	1	67	71	III	SP
		PAJAM	1	77	72	III	SP
		RINCHING	1	74	60	III	SP
		SEMENYIH	3	82	77	II	SP
	SEPANG	SEPANG	3	76	75	III	SP
	TENGI	TENGI	3	80	77	II	SP
	SELANGOR	AIR HITAM	1	75	68	III	SP
		RAWANG	1	78	72	III	SP
		SEMBAH	1	78	68	III	SP
SELANGOR/ WPKL	KLANG	AMPANG	1	64	69	III	SP
		BATU	3	72	71	III	SP
		KLANG	10	63	60	III	SP
		KUYOH	1	64	63	III	SP
N.SEMBILAN	LUKUT	LUKUT	1	77	72	III	SP
	LINGGI	KAYU ARA	1	72	68	III	SP
		KEPAYONG	1	77	78	II	SP
		LINGGI	6	75	75	III	SP
		PAROI	1	75	78	II	SP
		PEDAS	1	82	79	II	SP
		SENAWANG	1	65	67	III	SP
		SIMIN	1	77	73	III	SP
		SIMPANG EMPAT	1	81	78	II	SP
		TEMIANG	2	67	68	III	SP
MELAKA	TUANG	BARU	1	71	69	III	SP
	SERI MELAKA	SERI MELAKA	1	68	67	III	SP
	MELAKA	MELAKA	9	70	70	III	SP
		PUTAT	2	61	60	III	SP
		REMBIA	2	70	70	III	SP
	KESANG	TANGKAK	1	66	63	III	SP
	DUYONG	DUYONG	3	77	78	II	SP
JOHOR/ N.SEMBILAN	MUAR	GEMAS	1	85	78	II	SP
		GEMENCHEH	2	82	79	II	SP
		LABIS	3	81	80	II	SP

Table 3.2 Malaysia : Water Quality Status of Slightly Polluted Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
JOHOR/ N.SEMBILAN		MERBUDU	1	78	74	III	SP
		MERLIMAU	1	75	66	III	SP
		MUAR	17	83	79	II	SP
		PALONG	2	81	79	II	SP
		SENARUT	1	76	66	III	SP
		SEROM	1	74	70	III	SP
		SPG. LOI	1	76	77	II	SP
		TENANG	1	80	68	III	SP
JOHOR	BATU PAHAT	AMRAN	1	79	68	III	SP
		BATU PAHAT	1	65	60	III	SP
		BEKOK	5	82	80	II	SP
		BERLIAN	1	75	69	III	SP
		MERPO	1	83	74	III	SP
		SEMBERONG	2	72	64	III	SP
		SIMPANG KIRI	3	70	66	III	SP
	RAMBAH	RAMBAH	2	58	63	III	SP
	BENUT	BENUT	4	77	76	III	SP
		PARIT HJ. YASSIN	1	85	80	II	SP
		PINGGAN	1	71	65	III	SP
	PONTIAN BESAR	AIR HITAM	1	70	71	III	SP
		PONTIAN BESAR	5	70	67	III	SP
	PONTIAN KECIL	PONTIAN KECIL	2	78	75	III	SP
	SKUDAI	MELANA	2	65	64	III	SP
		SKUDAI	9	70	64	III	SP
	SANGLANG	SANGLANG	1	61	61	III	SP
	PULAI	PULAI	2	80	79	II	SP
		ULU CHOH	1	68	67	III	SP
	KIM-KIM	KIM-KIM	2	67	75	III	SP
	JEMALUANG	JEMALUANG	2	83	80	II	SP
	ENDAU	DENGAR	1	73	63	III	SP
		JEBONG	1	76	72	III	SP
		MELATAI	1	62	61	III	SP
		MENGKIBOL	3	74	71	III	SP
		PAMOL	1	69	70	III	SP
	TEBRAU	TEBRAU	5	73	69	III	SP
	JOHOR	BERANGAN	1	68	63	III	SP
		LEBAM	1	81	75	III	SP
		SEBOL	1	86	78	II	SP
		SEMENCHU	1	81	74	III	SP
		TIRAM	4	80	74	III	SP
	SEDILI BESAR	MUPUR	1	68	75	III	SP
		PASIR PANJANG	1	74	76	III	SP
PAHANG	BEBAR	BEBAR	2	82	75	III	SP
		SERAI	2	78	72	III	SP
	BALOK	BALOK	2	73	76	III	SP
		PANJANG	1	78	74	III	SP
		YIOR	1	71	65	III	SP
	CHERATING	CHERATING	1	80	80	II	SP

Table 3.2 Malaysia : Water Quality Status of Slightly Polluted Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
PAHANG	TONGGOK	TONGGOK	2	79	77	II	SP
	ROMPIN	BAKAR	1	78	72	III	SP
	PAHANG	ANAK SG. LEPAR	1	76	68	III	SP
		BATU	1	73	68	III	SP
		KUNDANG	1	78	76	III	SP
		SERTING	5	81	75	III	SP
	KUANTAN	GALING BESAR	1	46	60	III	SP
		GALING KECIL	1	59	69	III	SP
		PINANG	1	81	80	II	SP
		REMAN	1	66	73	III	SP
		RIAU	1	77	74	III	SP
		TALAM	1	81	72	III	SP
TERENGGANU	KEMAMAN	NERAM	1	63	77	II	SP
	PAKA	RENGAT	1	75	80	II	SP
	TERENGGANU	NERUS	4	77	66	III	SP
	BESUT	JERTIH	1	86	73	III	SP
TERENGGANU	CHUKAI	BUNGKUS	1	81	77	II	SP
		RUANG	2	69	70	III	SP
	IBAI	IBAI	3	78	75	III	SP
	MERCHANG	LANDAS	1	51	67	III	SP
		MERCHANG	1	71	73	III	SP
	MERANG	MERANG	1	71	69	III	SP
KELANTAN	KEMASIN	KEMASIN	2	81	80	II	SP
	GOLOK	TASIK GARU	1	75	78	II	SP
	PENGKALAN CHEPA	ALOR B	1	61	65	III	SP
		KELADI	1	82	76	III	SP
		PENGKALAN CHEPA	2	77	78	II	SP
		RAJA GALI	1	73	78	II	SP
SARAWAK	KAYAN	KAYAN	3	82	76	III	SP
	SEMUNSAM	SEMUNSAM	1	86	80	II	SP
	BALINGIAN	BALINGIAN	2	81	80	II	SP
	NIAH	NIAH	2	82	80	II	SP
		SEKALOH	2	79	70	III	SP
	SADONG	KARANGAN	2	72	61	III	SP
		SADONG	4	79	71	III	SP
	SARIBAS	LAYAR	2	82	79	II	SP
		SARIBAS	1	70	73	III	SP
	KERIAN	KERIAN	2	78	71	III	SP
		SEBLAK	1	79	77	II	SP
	MUKAH	MUKAH	4	77	75	III	SP
	KEMENA	KEMENA	4	78	77	II	SP
		SIBIU	1	81	73	III	SP
	SUAI	SUAI	1	79	78	II	SP
	SIBUTI	KABULOH	2	68	64	III	SP
		SATAP	1	80	79	II	SP
		SIBUTI	2	81	79	II	SP
	MIRI	DALAM	1	72	60	III	SP
		LUTONG	2	67	70	III	SP

Table 3.2 Malaysia : Water Quality Status of Slightly Polluted Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
SARAWAK		MIRI	2	57	65	III	SP
	BARAM	BARAM	4	79	77	II	SP
		TUTUH	1	77	80	II	SP
	SARAWAK	KELANTAN	1	63	66	III	SP
		MAONG KIRI	1	65	71	III	SP
		SAMARAHAN	2	78	75	III	SP
		SARAWAK KIRI	1	86	79	II	SP
		SEMENGGOH	1	75	78	II	SP
	LUPAR	LUPAR	3	75	73	III	SP
	RAJANG	MERADONG	1	74	80	II	SP
		RAJANG	11	78	79	II	SP
		SALIM	1	73	80	II	SP
		SARIKEI	2	82	80	II	SP
SABAH	PADAS	PADAS	3	84	77	II	SP
	SEGAMA	SEGAMA	3	85	80	II	SP
	UMAS-UMAS	UMAS-UMAS	1	82	77	II	SP
	KALABAKAN	KALABAKAN	3	82	75	III	SP
	SEMBULAN	SEMBULAN	2	67	68	III	SP
	LIKAS	DARAU	1	75	75	III	SP
		LIKAS	2	63	65	III	SP
	SEGALIUD	SEGALIUD	2	79	78	II	SP
	KINABATANGAN	KINABATANGAN	4	78	78	II	SP
		LEEPANG	1	80	76	III	SP
		MENANGGUL	1	76	72	III	SP
		PIN	1	79	78	II	SP
		TAKALA	1	72	77	II	SP
	KALUMPANG	PANG BURONG 2	1	64	63	III	SP

Table 3.3 Malaysia : Water Quality Status of Polluted Rivers, 2009

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
KEDAH	MERBOK	KOROK	1	57	45	IV	P
		PETANI	1	53	58	III	P
P.PINANG	PINANG	DONDANG	3	49	51	IV	P
		JELUTONG	1	38	39	IV	P
	JURU	ARA	1	58	49	IV	P
		RAMBAI	2	55	53	III	P
	PERAI	AIR MELINTAS	1	40	50	IV	P
		KEREH	2	50	57	III	P
		SELUANG	1	54	56	III	P
P.PINANG	JAWI	CHEMPEDAK	1	43	44	IV	P
		JAWI	1	57	52	III	P
		TENGAH	1	46	36	IV	P
PERAK	PERAK	SELUANG	1	59	52	III	P
	SEPETANG	LIDIN	1	69	58	III	P
SELANGOR	LANGAT	BATANG NILAI	2	54	53	III	P
	SEPANG	RAMBAI	1	62	54	III	P
	SELANGOR	KUNDANG	1	72	57	III	P
	BULOH	BULOH	5	67	58	III	P
SELANGOR/ WPKL	KLANG	BUNOS	1	55	47	IV	P
		DAMANSARA	3	64	59	III	P
		JINJANG	2	52	58	III	P
		KERAYONG	2	51	48	IV	P
		KEROH	2	51	50	IV	P
		PENCHALA	1	46	42	IV	P
MELAKA	TUANG	TUANG	1	48	38	IV	P
	SERI MELAKA	AIR SALAK	1	66	58	III	P
	KESANG	CHIN-CHIN	1	55	54	III	P
	MERLIMAU	MERLIMAU	4	60	54	III	P
JOHOR/ N.SEMBILAN	MUAR	KELAMAH	1	64	55	III	P
		SARANG BUAYA	1	67	53	III	P
JOHOR	BATU PAHAT	SIMPANG KANAN	2	66	58	III	P
	PONTIAN BESAR	AYER MERAH	1	42	35	IV	P
	ENDAU	LENGA	1	63	56	III	P
	JOHOR	SERAI	1	59	57	III	P
	AIR BALOI	AIR BALOI	3	51	48	IV	P
	SEGGET	SEGGET	5	52	50	IV	P
	TEBRAU	BALA	1	54	56	III	P
		PANDAN	1	50	51	IV	P
		PLENTONG	1	47	42	IV	P
		SEBULUNG	1	48	44	IV	P
		SENGKUANG	1	49	31	IV	P
		TAMPOI	1	47	41	IV	P
	DANGA	DANGA	2	52	52	III	P
	KAW. PASIR GUDANG	BULUH	1	33	36	IV	P
		LATOH	1	53	57	III	P
		MASAI	1	56	57	III	P
		PEREMBI	1	52	46	IV	P
		TUKANG BATU	1	26	36	IV	P

Table 3.3 Malaysia : Water Quality Status of Polluted Rivers, 2009 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2009)	
				2008	2009	CLASS	CATEGORY
JOHOR	KEMPAS	KEMPAS	2	63	57	III	P
PAHANG	ROMPIN	SEPAYANG	1	68	56	III	P
TERENGGANU	KEMAMAN	RANSAN	2	75	58	III	P
KELANTAN	PENGKALAN CHEPA	ALOR LINTAH	1	58	55	III	P
SARAWAK	MIRI	ADONG	1	53	56	III	P
SABAH	KALUMPANG	PANG BURONG 1	1	66	49	IV	P

Table 3.4 Malaysia : Pollution Influx Observed at Continuous Water Quality Station

Station	Date	Parameter	Pollution Sources
Batang Benar	28-Jan-09	pH: 4.95	Sewage or latex based industry or industrial discharge
Melaka	30-Jan-09	NH_4: 1.56 mg/l	Sewage or latex based industry
Melaka	20-Feb-09	pH: 10.30	Sewage or latex based industry
Batang Benar	24-Feb-09	pH: 10.61	Sewage or latex based industry or industrial discharge
Batang Benar	6-Mar-09	pH: 8.97	Sewage or latex based industry or industrial discharge
Batang Benar	21-Mar-09	NH_4: 4.28 mg/l	Sewage or latex based industry or industrial discharge
Batang Benar	23-Mar-09	NH_4: 4.32 mg/l	Sewage or latex based industry or industrial discharge
Batang Benar	26-Mar-09	pH: 8.89	Sewage or latex based industry or industrial discharge
Batang Benar	31-Mar-09	pH: 9.12	Sewage or latex based industry or industrial discharge
Batang Benar	10-Apr-09	NH_4: 3.42 mg/l	Sewage or latex based industry or industrial discharge
Labu	28-Apr-09	NH_4: 4.01 mg/l	Sewage or latex based industry or industrial discharge
Labu	2-May-09	NH_4: 4.68 mg/l	Sewage or latex based industry or industrial discharge
Melaka	25-May-09	pH: 8.44	Sewage or latex based industry
Batang Benar	28-May-09	pH: 9.17	Sewage or latex based industry or industrial discharge
Batang Benar	1-Jun-09	pH: 8.64	Sewage or latex based industry or industrial discharge
Melaka	11-Jun-09	pH: 10.76	Sewage or latex based industry
Batang Benar	15-Jul-09	pH: 9.71	Sewage or latex based industry or industrial discharge
Batang Benar	19-Jul-09	NH_4: 5.56 mg/l	Sewage or latex based industry or industrial discharge
Batang Benar	10-Aug-09	pH: 9.82	Sewage or latex based industry or industrial discharge
Labu	10-Aug-09	NH_4: 20.32 mg/l	Sewage or latex based industry or industrial discharge
Melaka	12-Aug-09	pH: 9.33	Sewage or latex based industry
Labu	17-Aug-09	NH_4: 14.83 mg/l	Sewage or latex based industry or industrial discharge
Batang Benar	17-Aug-09	pH: 8.77	Sewage or latex based industry or industrial discharge
Batang Benar	22-Aug-09	pH: 8.92	Sewage or latex based industry or industrial discharge
Batang Benar	6-Sep-09	pH: 8.44	Sewage or latex based industry or industrial discharge
Labu	15-Sep-09	NH_4: 12.98 mg/l	Sewage or latex based industry or industrial discharge
Batang Benar	14-Oct-09	pH: 10.11	Sewage or latex based industry or industrial discharge
Melaka	24-Oct-09	pH: 8.29	Sewage or latex based industry
Melaka	27-Oct-09	pH: 9.22	Sewage or latex based industry
Keratong	20-Nov-09	NH_4: 2.64 mg/l	Sewage or latex based industry
Batang Benar	5-Dec-09	pH: 8.40	Sewage or latex based industry or industrial discharge
Melaka	8-Dec-09	pH: 8.01	Sewage or latex based industry or industrial discharge
Melaka	14-Dec-09	pH: 8.28	Sewage or latex based industry or industrial discharge

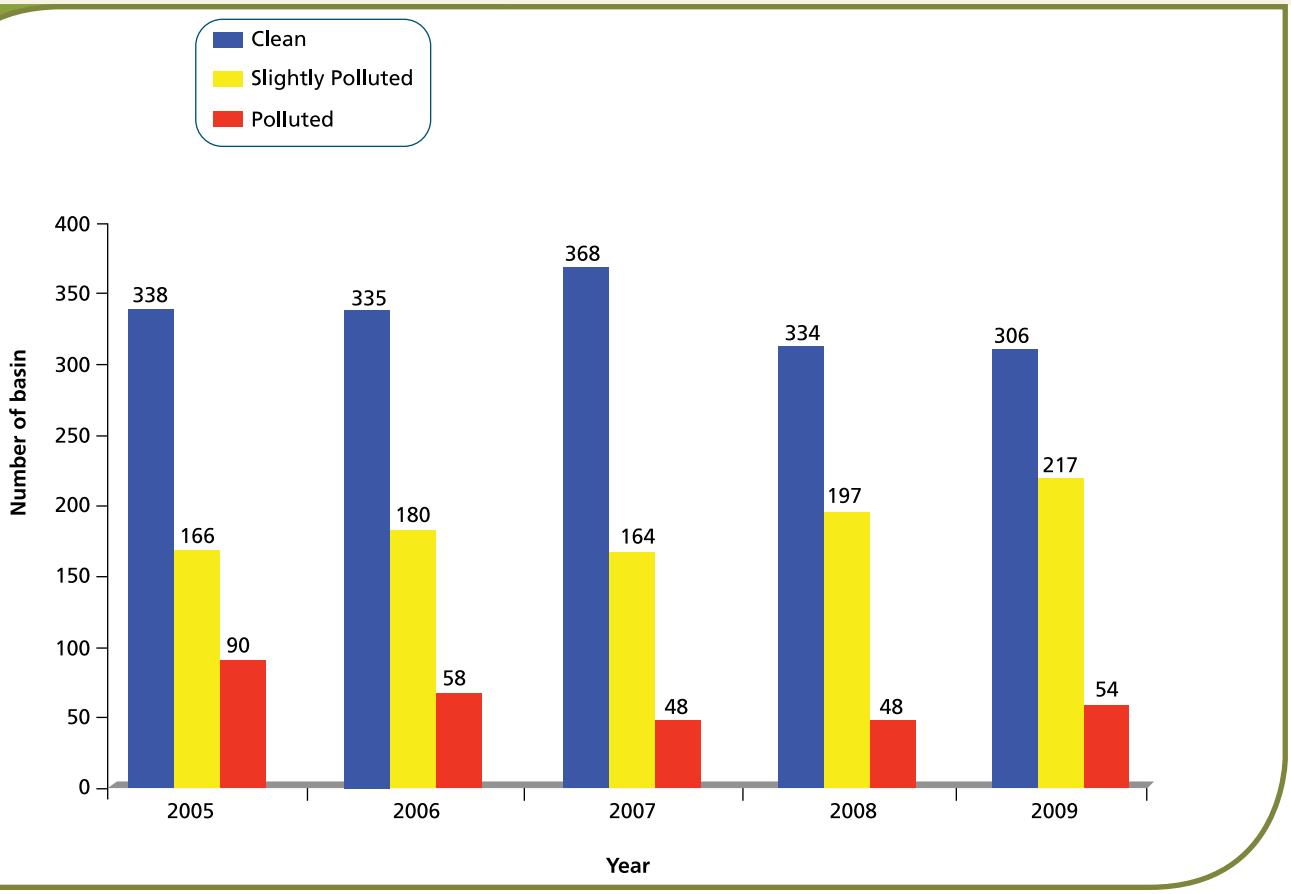


Figure 3.1Malaysia : River Water Quality Trend (2005 - 2009)

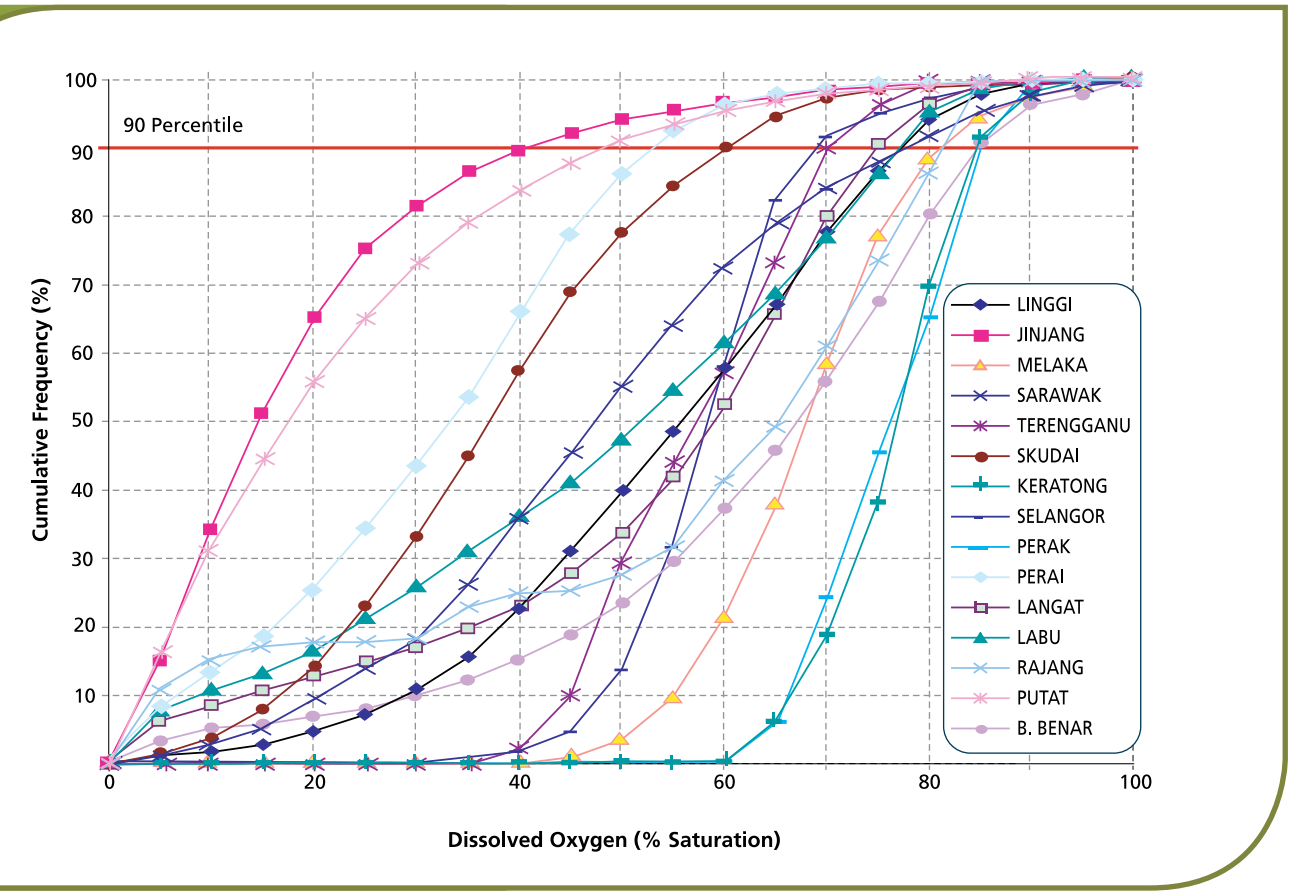


Figure 3.2 Malaysia : Comparison of Cumulative Frequency for 15 CWQM Stations - Dissolved Oxygen : 1st January - 31st December 2009

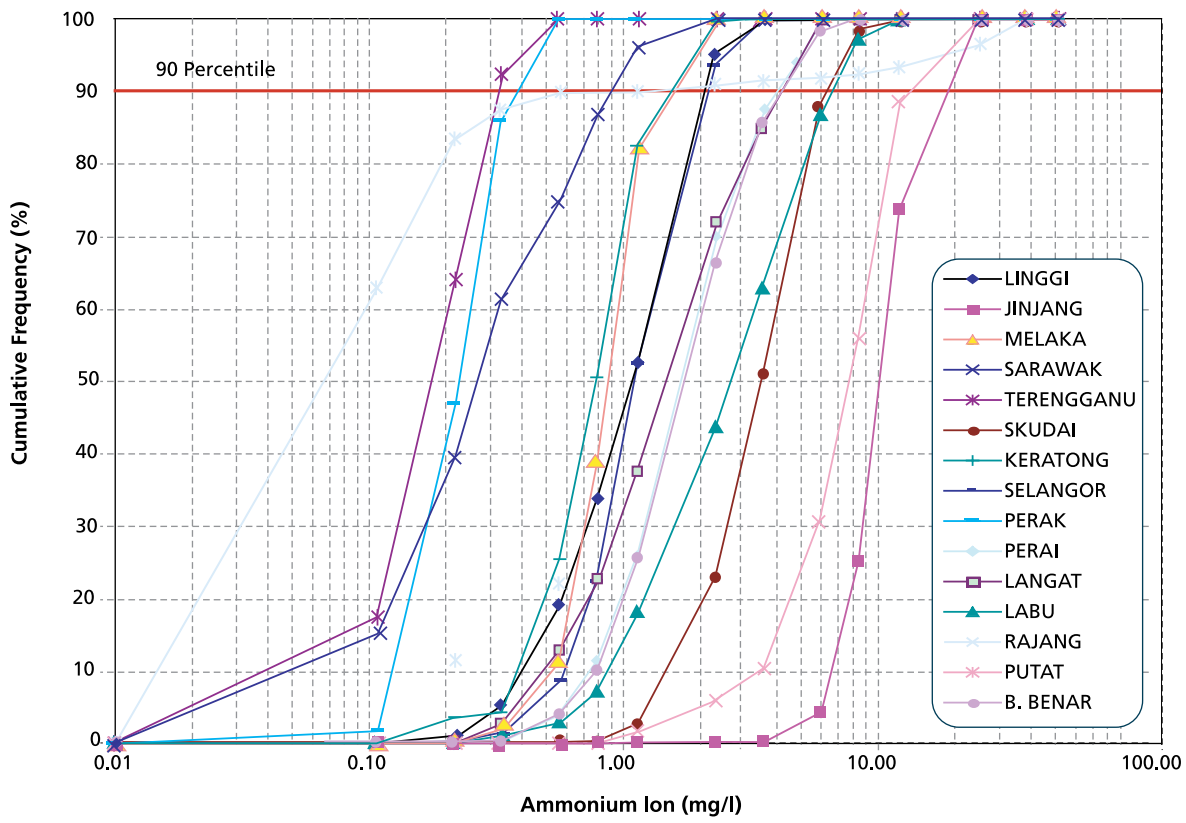


Figure 3.3 Malaysia : Comparison of Cumulative Frequency for 15 CWQM Stations - Ammonium Ion Concentration : 1st January - 31st December 2009

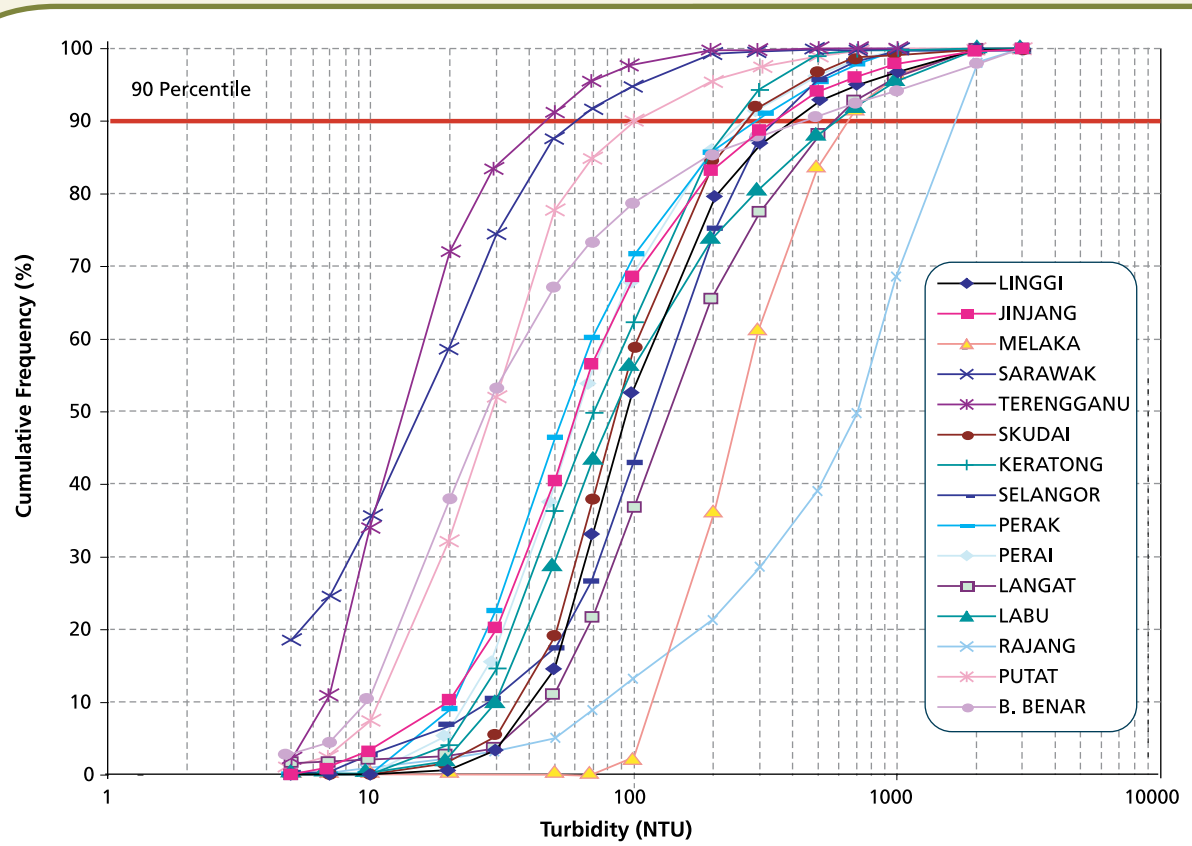


Figure 3.4 Malaysia : Comparison of Cumulative Frequency for 15 CWQM Stations - Turbidity : 1st January - 31st December 2009

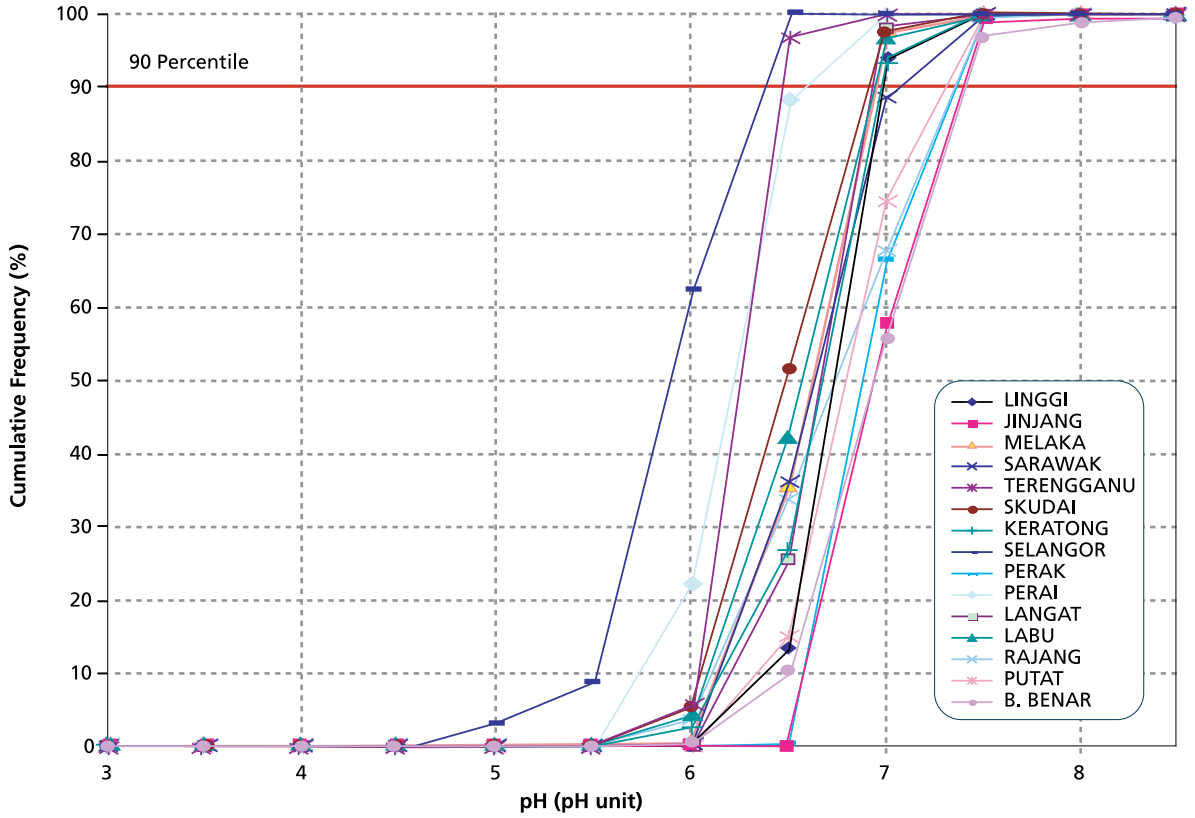


Figure 3.5 Malaysia : Comparison of Cumulative Frequency for 15 CWQM Stations - pH Level : 1st January - 31st December 2009

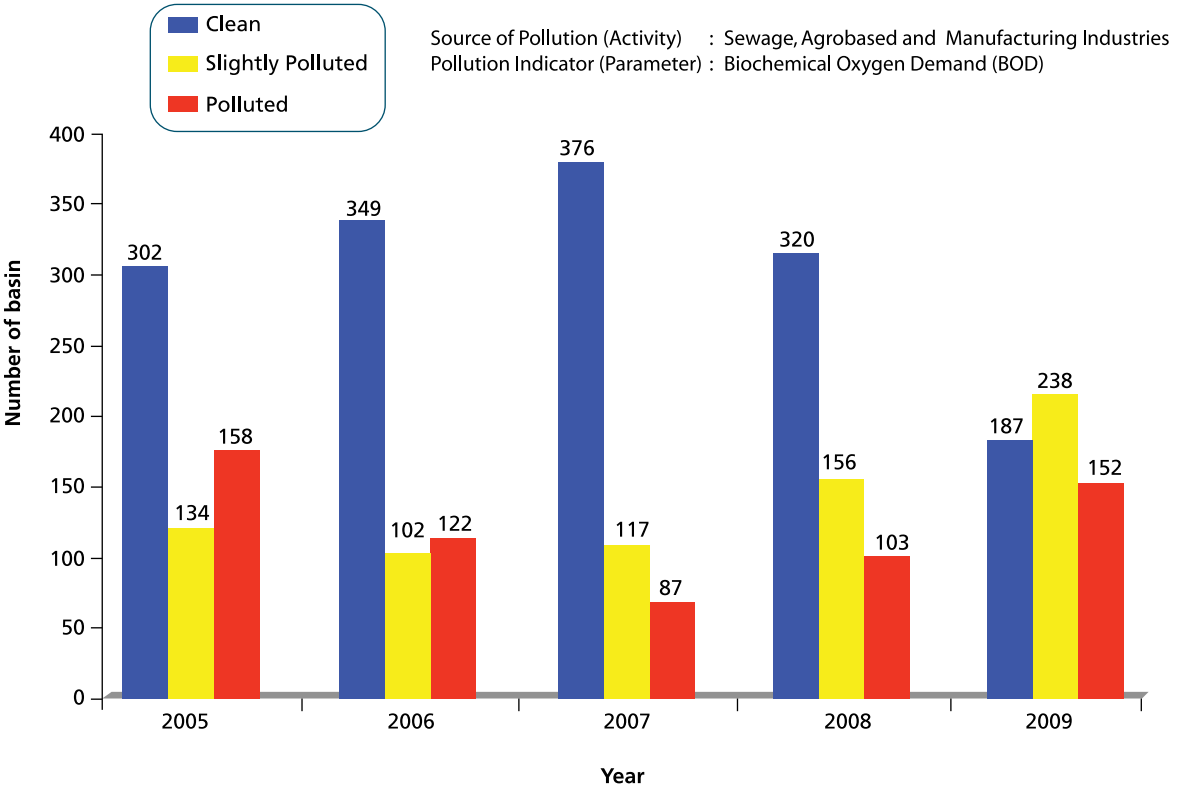


Figure 3.6 Malaysia : River Water Quality Trend based on BOD sub-index (2005 - 2009)

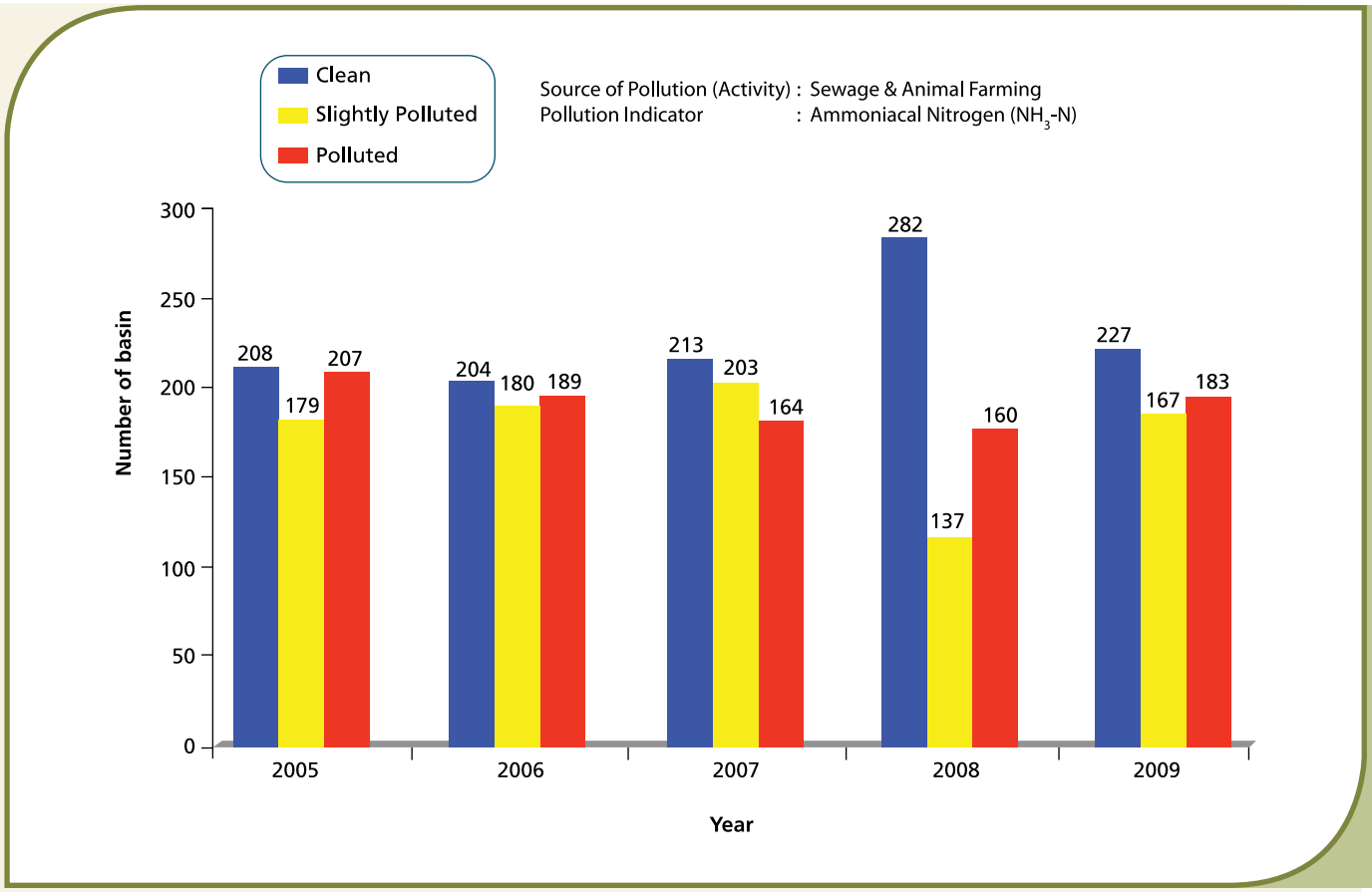


Figure 3.7 Malaysia: River Water Quality Trend based on AN sub-index (2005 - 2009)

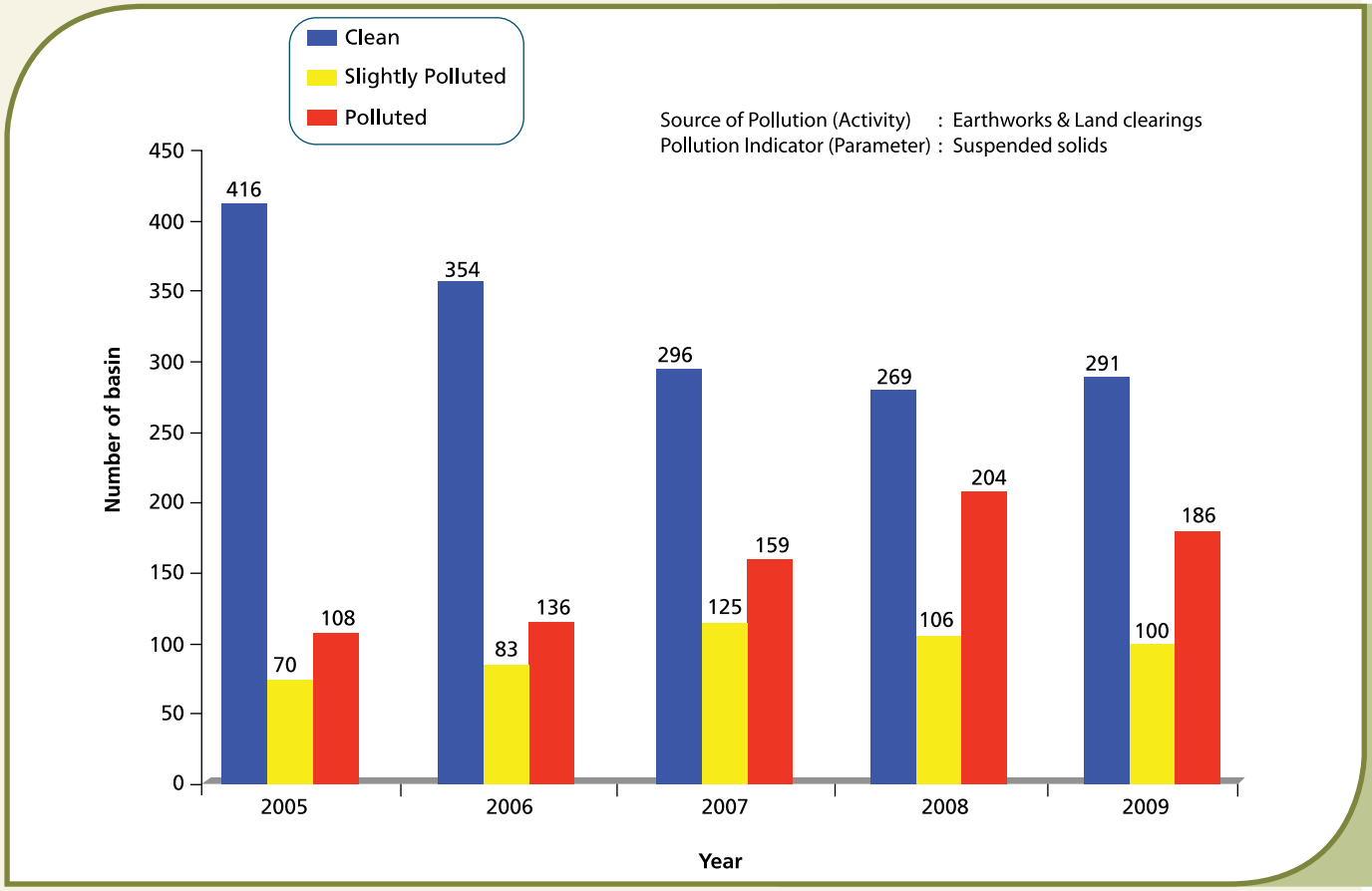
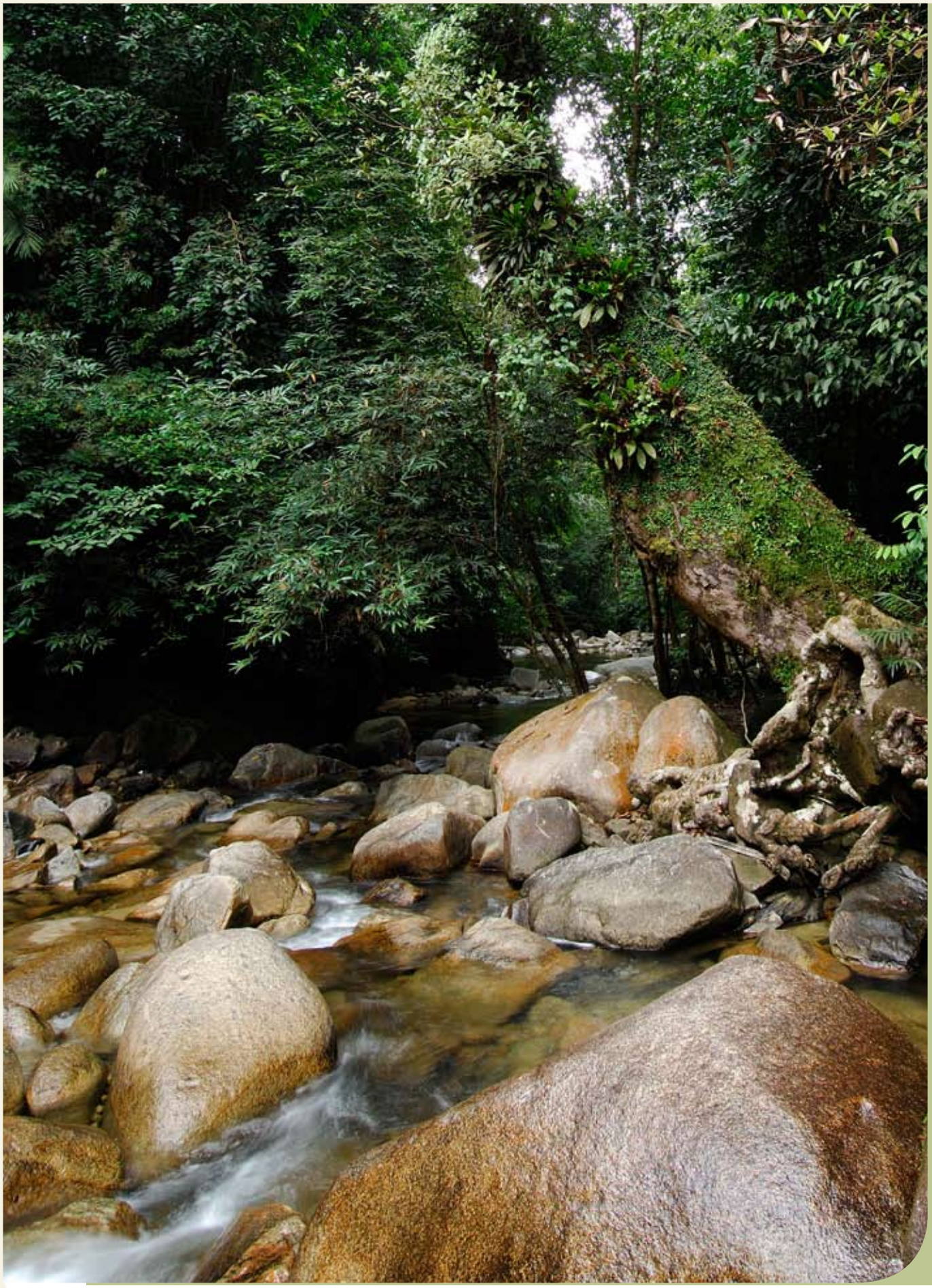


Figure 3.8 Malaysia: River Water Quality Trend based on SS sub-index (2005 - 2009)



A clean river is nature's beauty

Chapter 4: Groundwater Quality

Chapter 4: Groundwater Quality

GROUNDWATER QUALITY MONITORING

Groundwater quality monitoring was carried out at 81 monitoring wells in Peninsular Malaysia, 16 wells in Sarawak and 15 wells in Sabah **(Table 4.1)** as part of the National Groundwater Monitoring Programme that was initiated in 1997. The sites selected were according to the land use such as agricultural, urban/suburban, rural and industrial and special interests sites such as solid waste landfills, golf courses, resorts, animal burial areas, municipal water supply and ex-mining (gold mine).

GROUNDWATER QUALITY STATUS

In 2009, 335 water samples were taken from these monitoring wells and analysed for volatile organic compounds (VOCs), pesticides, heavy metals, anions, bacteria (coliform), phenolic compounds, radioactivity (Gross Alpha and Beta), total hardness, total dissolved solids (TDS), pH, temperature, conductivity and dissolved oxygen (DO). The results were than compared with the National Guidelines For Raw Drinking Water Quality established by the Ministry of Health (Revised December 2000) **(Table 4.2)** to determine the status of its quality.

Green agricultural practices

From the monitoring results it was found that arsenic (As), iron (Fe), manganese (Mn), total coliform and phenol recorded the most number of samples in all categories of land use exceeding the guideline values. The least number of samples exceeding the guideline values were mercury (Hg), and chromium (Cr), cadmium (Cd), nitrate (NO_3) and sulphate (SO_4). There was no exceedance of copper (Cu) and zinc (Zn) recorded in all samples monitored. **Figure 4.1** shows the percentage of the samples exceeding the guideline values for all the parameters monitored.

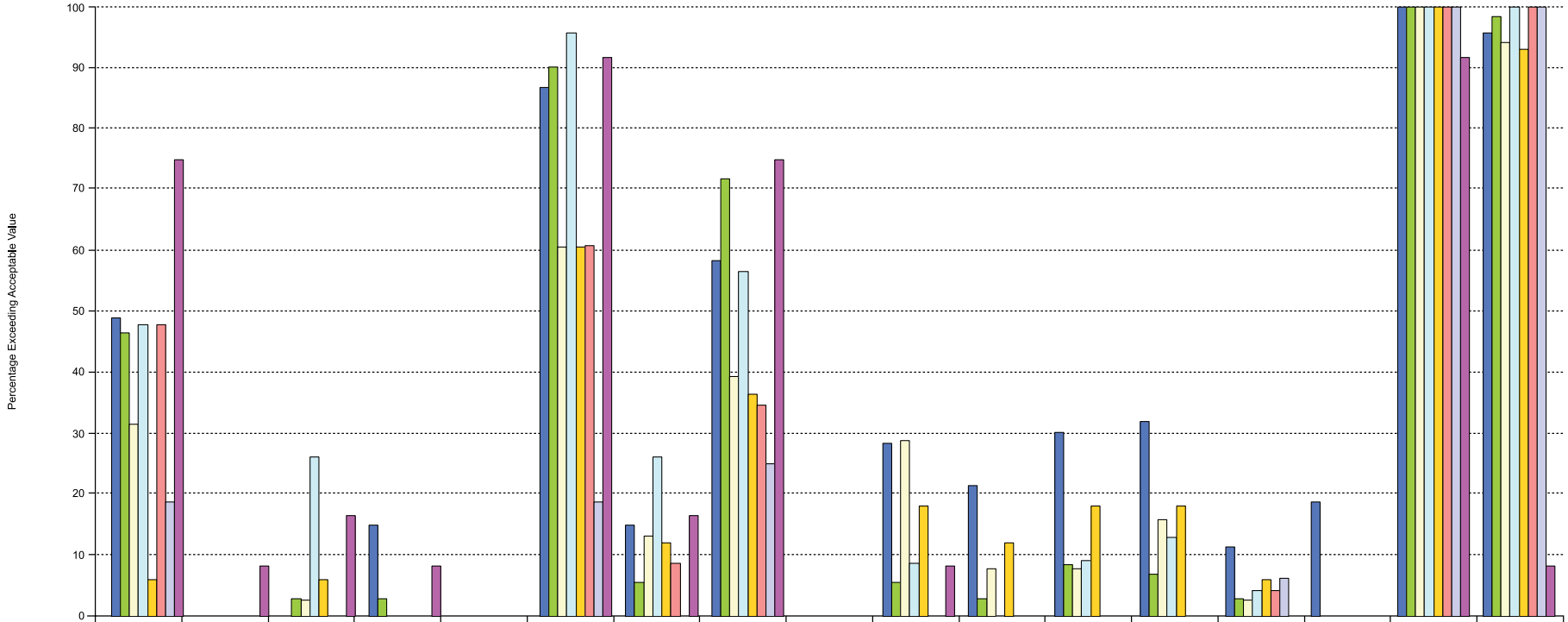
Table 4.1 Malaysia : Distribution of Groundwater Monitoring Wells, 2009

Category	Number of Wells
Agricultural Areas	12
Urban/Suburban Areas	11
Industrial Sites	18
Solid Waste Landfills	25
Golf Courses	7
Radioactive Landfill	1
Rural Areas	5
Ex-mining Areas (Gold Mine)	3
Municipal Water Supply	9
Animal Burial Areas	14
Aquaculture Farms	6
Resorts	1
Total	**112**

Table 4.2 Malaysia : National Guidelines for Raw Drinking Water Quality (Revised December 2000)

Parameter	Symbol	Benchmark
Sulphate	SO_4	250 mg/l
Hardness	$CaCO_3$	500 mg/l
Nitrate	NO_3	10 mg/l
Coliform	-	Must not be detected in any 100 ml 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	-	0.002 mg/l
TDS	-	1000 mg/l
Iron	Fe	0.3 mg/l
Copper	Cu	1.0 mg/l
Lead	Pb	0.01 mg/l
Cadmium	Cd	0.003 mg/l
Mercury	Hg	0.001 mg/l

Source:
Ministry of Health, Malaysia



	As	Hg	Cd	Cr	Cu	Fe	Pb	Mn	Zn	Se	$CaCO_3$	TDS	Cl	NO_3	SO_4	T-Colifom	Phenol
Industrial	49	0	0	15	0	87	15	58	0	28	22	30	32	11	19	100	96
Landfills	46	0	3	3	0	90	6	72	0	6	3	9	7	3	0	100	98
Agriculture	32	0	3	0	0	61	13	39	0	29	8	8	16	3	0	100	94
Municipal Water Supply	48	0	26	0	0	96	26	57	0	9	0	9	13	4	0	100	100
Urban/Suburban	6	0	6	0	0	61	12	36	0	18	12	18	18	6	0	100	93
Golf Courses	48	0	0	0	0	61	9	35	0	0	0	0	0	4	0	100	100
Rural Areas	19	0	0	0	0	19	0	25	0	0	0	0	0	6	0	100	100
Ex-Mining	75	8	17	8	0	92	17	75	0	8	0	0	0	0	0	92	8

Figure 4.1 Malaysia : Percentage of Non-Compliance of Selected Contaminants by Land Use, 2009

Chapter 5: Marine and Island Marine Water Quality

MARINE WATER QUALITY MONITORING

The Department of Environment (DOE) continues with the marine water quality monitoring programme that was started in 1978 for Peninsular Malaysia and in 1985 for Sabah and Sarawak. Marine water quality monitoring plays an important role in determining the degree of pollution from land-based sources as well as from sea based sources that can pose threats to the marine resources which contribute to the stability and diversity of the marine ecosystem.

The marine water quality monitoring programme included in-situ measurements and laboratory analyses for parameters as listed in **Table 5.1**. The Malaysian Marine Water Quality Criteria and Standards (MWQCS) are as shown in **Table 5.2**.

MARINE WATER QUALITY FOR COASTALS AREAS

In 2009 a total of 738 samples from 158 coastal monitoring stations were collected for analysis as shown in **Table 5.3**. The most number of samples that exceeded Class 2 of the Marine Water Quality Criteria and Standards (MWQCS) were oil and grease (50.7%), followed by total suspended solids (47.2%) and *Escherichia coli* (45.7%).

Total suspended solids remained a significant contaminant of coastal water with 92 percent of samples from Pahang, followed by Sarawak (89%) and Selangor (83%) exceeded the MWQCS. Sabah recorded the lowest percentage (6%) exceeding the MWQCS while Labuan recorded no contamination of total suspended solids **(Table 5.3)**.

For oil and grease contamination, Selangor recorded the highest percentage (100%) exceeding the MWQCS, followed by Langkawi (81%), Kedah (75%) and Kelantan (75%), while Sabah, Sarawak and Labuan were free from oil and grease contamination. *E. coli* contamination was recorded highest in Selangor (91%), followed by Pulau Pinang (88%) and Melaka (80%).

Heavy metals pollution was comparatively low with copper (Cu) exceeding the MWQCS by 39.3

Recreational activity on the beachfront

Table 5.1 Malaysia: Marine Environmental Quality Parameters

In-situ Measurement	Unit	Parameter (Laboratory Analysis)	Unit
Temperature	°C	*Escherichia coli (E. coli)*	MPN/100ml
pH	-	Oil and Grease (O & G)	mg/l
Dissolved oxygen	% Sat	Total suspended solids (TSS)	mg/l
Dissolved oxygen	mg/l	Arsenic (As)	µg/l
Conductivity	µS/cm	Cadmium (Cd)	µg/l
Salinity	ppt	Total Chromium (Cr)	µg/l
Turbidity	NTU	Copper (Cu)	µg/l
Tarball	g/100m	Lead (Pb)	µg/l
		Mercury (Hg)	µg/l

percent, followed by lead (28.1%) and mercury (26.9%). Copper contamination was evident in Perak (100%) and Johor (78%).

Total suspended solids in the marine waters can be attributed to run off from land-based activities such as uncontrolled land clearing for development and agriculture activities as well as coastal development. The main sources of *Escherichia coli* were untreated or partially treated animal and domestic wastes and also uncontrolled sewage from coastal premises including hotels and restaurants. The presence of oil and grease in the coastal waters were from discharges by shipping vessels and leakages and disposal of engine oil by boat operators. As for heavy metals they were mainly land-based uncontrolled industrial discharges.

MARINE WATER QUALITY FOR ESTUARIES

A total of 360 samples from 75 estuary monitoring stations were collected and analysed **(Table 5.4)**. The most number of samples exceeding the MWQCS (Class E) were *Escherichia coli* (56.9%), followed by oil and grease (47.6%) and total suspended solids (17.7%).

Escherichia coli remained a significant contaminant of estuary waters with Pulau Pinang recorded the highest percentage (87%) exceeding the MWQCS followed by Selangor (83%) and Perak (80%).

For oil and grease contamination, Selangor recorded the highest percentage (100%) exceeding the MWQCS, followed by Negeri Sembilan (88%) and Kelantan (70%), while Melaka dan Sabah were free from oil and grease contamination. Total suspended solids contamination was recorded highest in Selangor (37%), followed by Sarawak (36%) and Perak (30%).

Heavy metals pollution was comparatively low with lead (Pb) exceeding the MWQCS by 37.3 percent, followed by copper (37.1%) and mercury (36.2%). Lead contamination was evident in Sabah (100%) and Terengganu (81%).

Table 5.2 Malaysia: Marine Water Quality Criteria and Standards

	Parameter	CLASS 1	CLASS 2	CLASS 3	CLASS E
	BENEFICIAL USES	Preservation, marine protected areas, Marine Parks	Marine Life, Fisheries, Coral Reefs, Recreational and Mariculture	Ports, Oil & Gas Fields	Mangrove,s Estuarine & River-mouth Water
1	Temperature (°C)	≤2 °C increase over maximum ambient	≤2 °C increase over maximum ambient	≤2 °C increase over maximum ambient	≤2°C increase over maximum ambient
2	Dissolved Oxygen (mg/L)	>80% saturation	5.0	3.0	4.0
3	Total Suspended Solid (mg/L)	25 mg/L or ≤ 10% increase in seasonal average, whichever is lower	50mg/L (25 mg/L) or ≤ 10% increase in seasonal average, whichever is lower	100 mg/L or ≤10 increase in seasonal average, whichever is lower	100 mg/L or ≤ 30% increase in seasonal average, whichever is lower
4	Oil and Grease (mg/L)	0.01	0.14	5	0.14
5	Mercury* (µg/L)	0.04	0.16 (0.04)	50	0.5
6	Cadmium (µg/L)	0.5	2 (3)	10	2
7	Chromium (VI)(µg/L)	5	10	48	10
8	Copper (µg/L)	1.3	2.9	10	2.9
9	Arsenic (III)* (µg/L)	3	20(3)	50	20 (3)
10	Lead (µg/L)	4.4	8.5	50	8.5
11	Zinc (µg/L)	15	50	100	50
12	Cyanide (µg/L)	2.0	7.0	20	7.0
13	Ammonia (unionized) (µg/L)	35	70	320	70
14	Nitrite (NO_2) (µg/L)	10	55	1,000	55
15	Nitrate (NO_3) (µg/L)	10	60	1,000	60
16	Phosphate (µg/L)	5	75	670	75
17	Phenol (µg/L)	1	10	100	10
18	Tributyltin (TBT) (µg/L)	0.001	0.01	0.05	0.01
19	Faecal Coliform (Human health protection for seafood consumption) - (MPN)	70 faecal coliform/100ml *70 E.coli/100 ml*	100 faecal coliform /100ml (70 faecal coliform /100ml) *100 E.coli/100ml (70 E.coli/100ml)*	200 faecal coliform /100ml *200 E.coli/100ml*	100 faecal coliform /100ml (70 faecal coliform /100ml) *100 E.coli/100ml (70 E.coli/100ml)*
20	Polycyclic Aromatic Hydrocarbon (PAHs) ng/g	100	200	1000	1000

* MWQCS in parentheses are for coastal and marine water areas where seafood for human consumption is applicable.

Table 5.3 Malaysia: Status of Marine Water Quality Parameters Exceeding Standards for Coastal (%), 2009

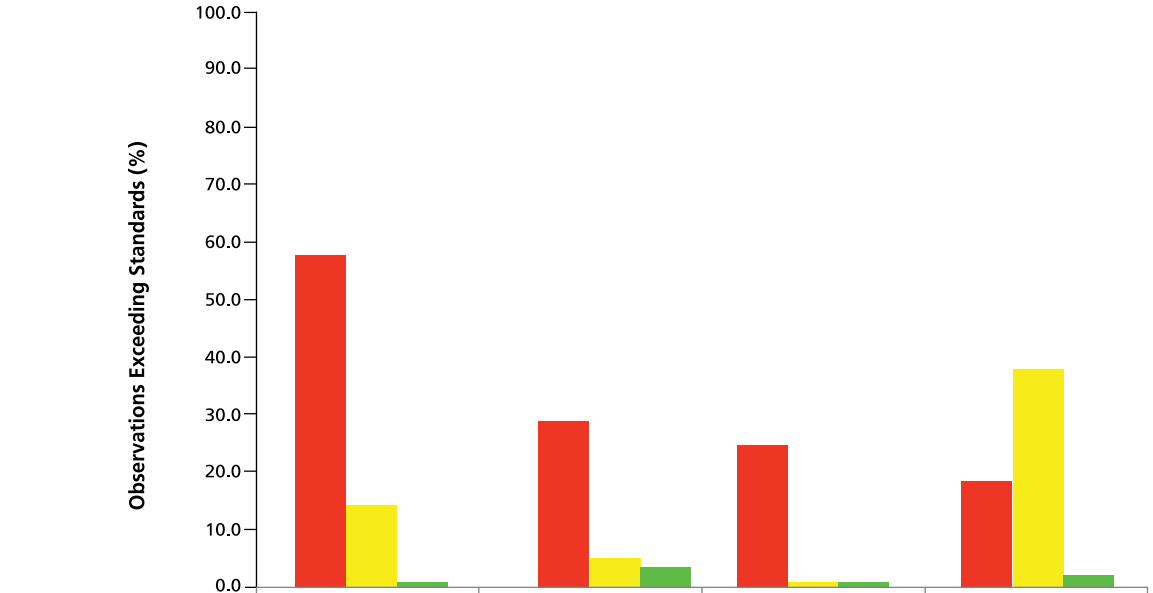
Parameter Exceeding Interim Standards (%)											
State	No. of Station	No of Sample	Total Suspended Solids	Oil and Grease	*Escherichia coli*	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury
Perlis	-	-	-	-	-	-	-	-	-	-	-
Pulau Langkawi	7	42	10	81	43	0	0	0	0	0	33
Kedah	1	5	75	75	40	0	0	25	0	0	100
Pulau Pinang	15	105	31	61	88	0	0	6	1	0	75
Perak	7	42	51	69	20	0	54	60	100	66	NA
Selangor	4	30	83	100	91	9	0	0	26	39	17
N. Sembilan	11	66	52	95	75	2	0	0	5	27	25
Melaka	7	39	48	0	80	0	0	0	44	24	0
Johor	39	122	24	54	49	0	1	5	78	10	15
Pahang	11	80	92	39	21	0	3	0	0	23	5
Terengganu	7	28	25	61	29	0	32	68	61	82	NA
Kelantan	5	20	75	75	25	0	95	45	60	75	29
W.P. Labuan	5	21	0	0	46	0	0	0	62	15	0
Sabah	24	100	6	0	6	0	16	6	68	29	0
Sarawak	15	38	89	0	27	3	14	3	46	3	24
Total	158	738	TSS	O & G	*E.coli*	As	Cd	Cr	Cu	Pb	Hg
Average (%)			47.2	50.7	45.7	1.0	15.4	15.6	39.3	28.1	26.9

Note : NA : Not available

Table 5.4 Malaysia: Status of Marine Water Quality Parameters Exceeding Standards for Estuary (%), 2009

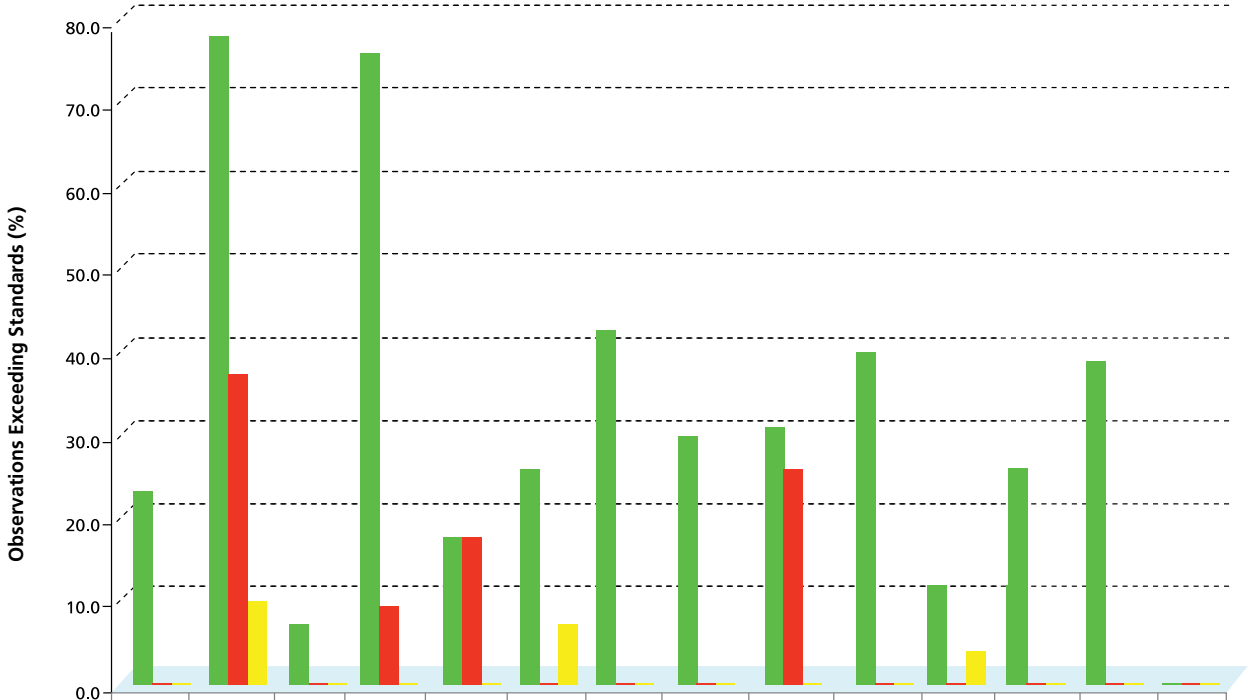
Parameter Exceeding Interim Standards (%)											
State	No. of Station	No of Sample	Total Suspended Solids	Oil and Grease	*Escherichia coli*	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury
Perlis	2	20	7	57	20	0	0	14	0	0	79
Pulau Langkawi	-	-	-	-	-	-	-	-	-	-	-
Kedah	2	10	13	38	40	0	0	13	0	0	50
Pulau Pinang	7	47	23	50	87	0	17	9	6	0	69
Perak	6	36	30	63	80	0	50	60	87	73	NA
Selangor	10	61	37	100	83	0	0	0	25	42	29
N. Sembilan	2	12	0	88	63	0	0	0	0	50	63
Melaka	5	29	32	0	53	0	0	0	37	26	0
Johor	12	42	10	35	53	0	0	0	55	0	16
Pahang	-	-	-	-	-	-	-	-	-	-	-
Terengganu	12	48	6	63	56	0	36	74	70	81	0
Kelantan	5	20	20	70	75	8	85	15	30	70	33
W.P. Labuan	-	-	-	-	-	-	-	-	-	-	-
Sabah	2	8	0	0	50	0	13	0	100	100	NA
Sarawak	10	27	36	8	24	4	20	0	36	4	24
Total	75	360	TSS	O & G	*E.coli*	As	Cd	Cr	Cu	Pb	Hg
Average (%)			17.7	47.6	56.9	1.0	18.4	15.4	37.1	37.3	36.2

Note : NA : Not available



	Development	Resort	Marine Park	Protected
E - coli	59.7	31.4	25.0	19.1
Total Suspended Solids	15.3	5.7	0.0	39.7
Oil - Grease	0.0	4.3	0.0	2.9

Figure 5.1 Malaysia : Island Marine Water Quality Status, 2009



	Kedah	P. Pinang	Perak	Selangor	Melaka	Johor	Pahang	Terengganu	Sarawak	W.P.Labuan	Sabah	N.Sembilan	Kelantan	Perlis
E. coli	22.2	77.3	6.3	75.0	16.7	25.0	41.7	28.8	30.0	38.9	11.0	25.0	38.0	0.0
Total Suspended Solids	0.0	36.4	0.0	8.3	16.7	0.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0
Oil & Grease	0.0	9.1	0.0	0.0	0.0	6.3	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0

Figure 5.2 Malaysia : Status of Island Marine Water Quality by State, 2009

ISLAND MARINE WATER QUALITY STATUS

The waters around 73 islands were monitored in 2009 that were categorized as development islands (3 islands), resort islands (31 islands), marine park islands (21 islands) and protected islands (18 islands). A total of 368 samples were collected and analysed. The main pollutants analysed were total suspended solids, *E. coli* and oil and grease. The analyses were based on Malaysia Marine Water Quality Criteria and Standards (MWQCS) by using Class 1 for marine park and protected islands and Class 2 for resort and development islands.

E. coli recorded the highest number of samples exceeding the MWQCS in all category islands monitored except for protected islands. In development islands 59.7 percent exceeded the standards followed by resort islands 31.4 percent and marine parks 25 percent. In terms of total suspended solids, protected islands and development islands recorded total suspended solids exceeding the standards by 39.7 and 15.3 percent respectively while marine parks recorded no contamination. For oil and grease, resort islands recorded the highest percentage (4.3%) exceeding the standards followed by protected islands (2.9%), while there was no contamination in marine parks and development islands **(Figure 5.1)**.

As shown in **Figure 5.2,** *E. coli* contamination was highest in Pulau Pinang island marine waters where 77.3 percent of the samples exceeded the standard of 100 MPN/100 ml followed by Selangor (75%) and Pahang (41.7%) whilst Perlis recorded no contamination. As for total suspended solids, Pulau Pinang recorded the highest samples exceeding the standard at 36.4 percent, followed by Sarawak (25%), Melaka (16.7%) and Selangor (8.3%). However, total suspended solids for islands in other states were in compliance. Oil and grease was detected in Pulau Pinang with 9.1 percent of samples monitored exceeded the standards, followed by Johor (6.3%) and Sabah (3%). Other states were free of oil and grease pollution.

Coastal development

TARBALL MONITORING

Tarball residues on beaches are usually caused by oily discharges from fishing boats as well as passing vessels. In 2009 it was found that all the 135 monitoring stations were free from tarball pollution.

ASSESMENT OF MARINE WATER QUALITY STATIONS

The assessment of the marine water quality stations status for coastal, estuaries and islands was conducted by examining the analytical results against the Malaysia Marine Water Quality Criteria and Standard (MWQCS) for TSS, Oil and Grease and *E.coli*. **Table 5.5** shows the 10 best coastal and estuarine water quality and **Table 5.6** shows the 10 best islands water quality.

Pristine marine environment near Pulau Besar off the coast of Melaka

Table 5.5 Malaysia: 10 Best Coastal and Estuary Sites 2009

State	Sites	Category
Sabah	-Mangrove Paradise	Coastal
	-Pantai Teluk Brunei 4	Coastal
	-Pantai Pasir Putih	Coastal
Sarawak	-Pantai Damai	Coastal
	-Kuala Sungai Semantan	Estuary
Pahang	-Pantai Sepat	Coastal
	-Pantai Lagenda	Coastal
Johor	-Kuala Sungai Kim Kim	Estuary
Terengganu	-Pantai Rantau Abang	Coastal
Perak	-Pantai Teluk Dalam	Coastal

Table 5.6 Malaysia: 10 Best Islands Monitoring Sites 2009

State	Sites	Category
Perak	-Pangkor (Pantai Puteri Dewi)	Resort
	-Pulau Sembilan	Marine Park
Sabah	-Pulau Manukan	Marine Park
	-Pulau Banggi	Resort
Terengganu	-Tenggol	Protected
	-Pulau Perhentian Kecil	Marine Park
	-Pulau Perhentian Besar	Marine Park
Sarawak	-Pulau Talang-talang Besar	Protected
Melaka	-Pulau Besar	Resort
Johor	-Pulau Nanga Besar	Marine Park

Chapter 6:
Pollution Sources Inventory

Chapter 6: Pollution Sources Inventory

WATER POLLUTION SOURCES

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

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

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

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

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

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

BOD LOAD

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

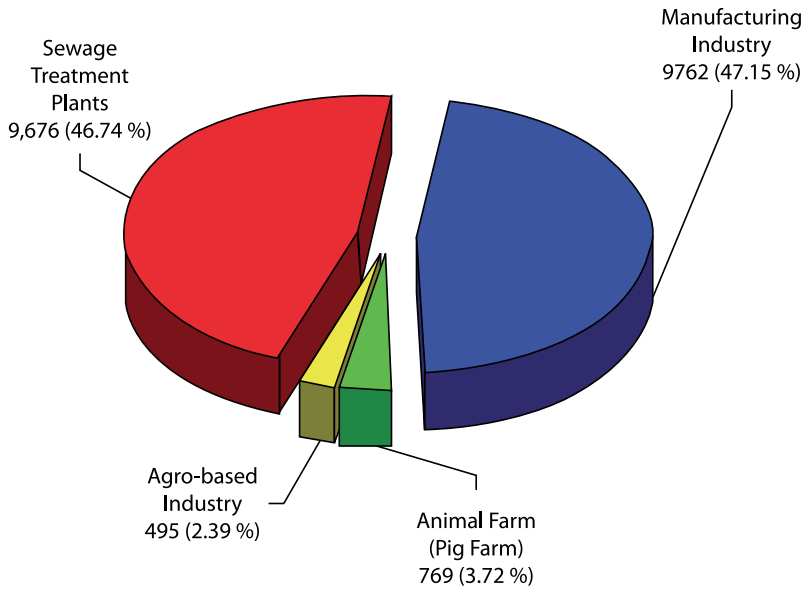


Figure 6.1 Malaysia : Composition of Water Pollution Sources by Sector, 2009

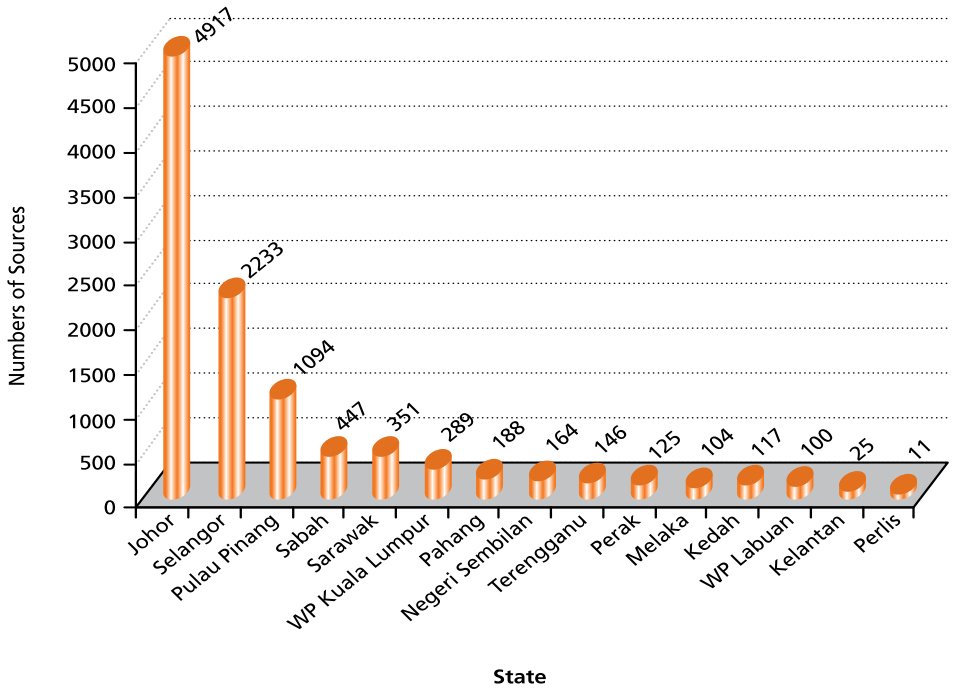


Figure 6.2 Malaysia : Distribution of Industrial Water Pollution Sources (Agro-based and Manufacturing Industries) by State, 2009

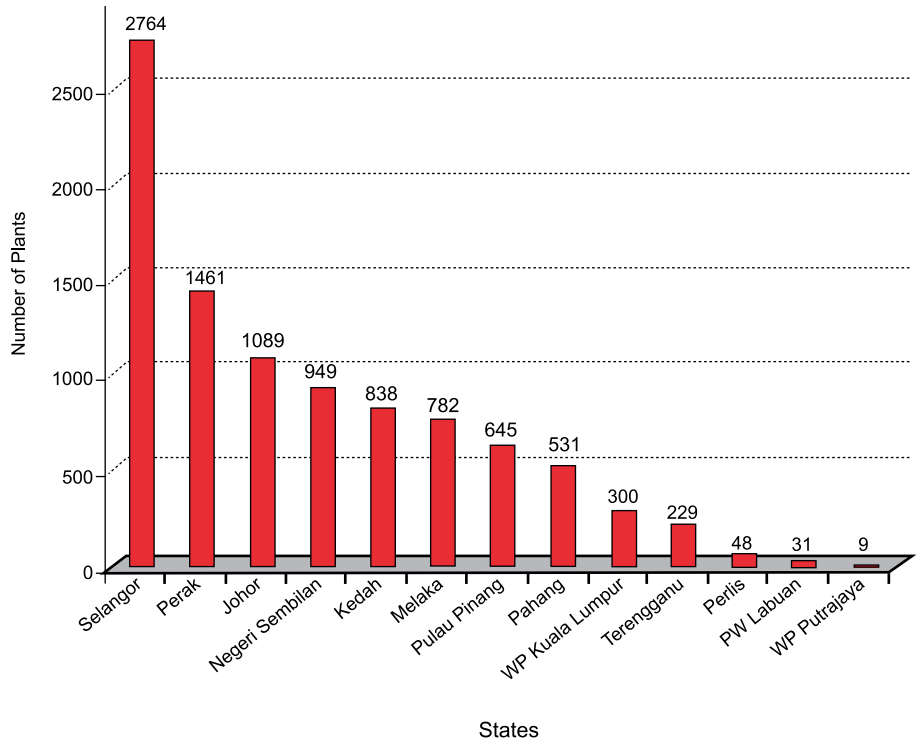


Figure 6.3 Malaysia : Distribution of Sewage Treatment Plants by State, 2009
Source : IWK Sdn. Bhd.

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

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

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

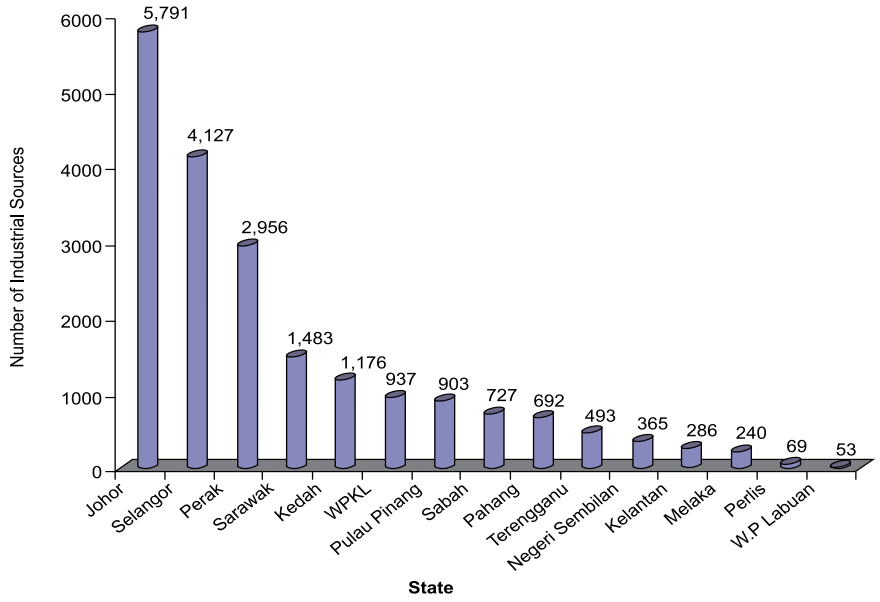


Figure 6.4 Malaysia : Industrial Air Pollution Sources by State, 2009

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

SOURCES OF AIR POLLUTION

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

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

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

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

AIR POLLUTANT EMISSION LOAD

Overall Emission Load

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

Emission Load by Sources

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

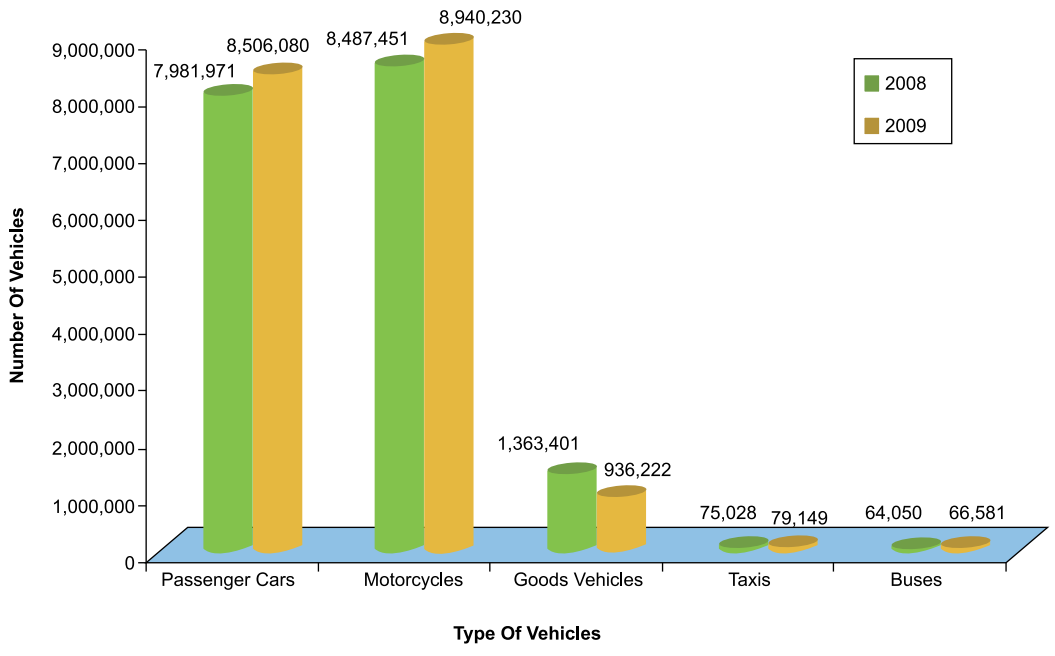


Figure 6.5 Malaysia : Number of Registered Vehicles in 2008 and 2009
(Source : Road Transport Department, Malaysia, 2009)

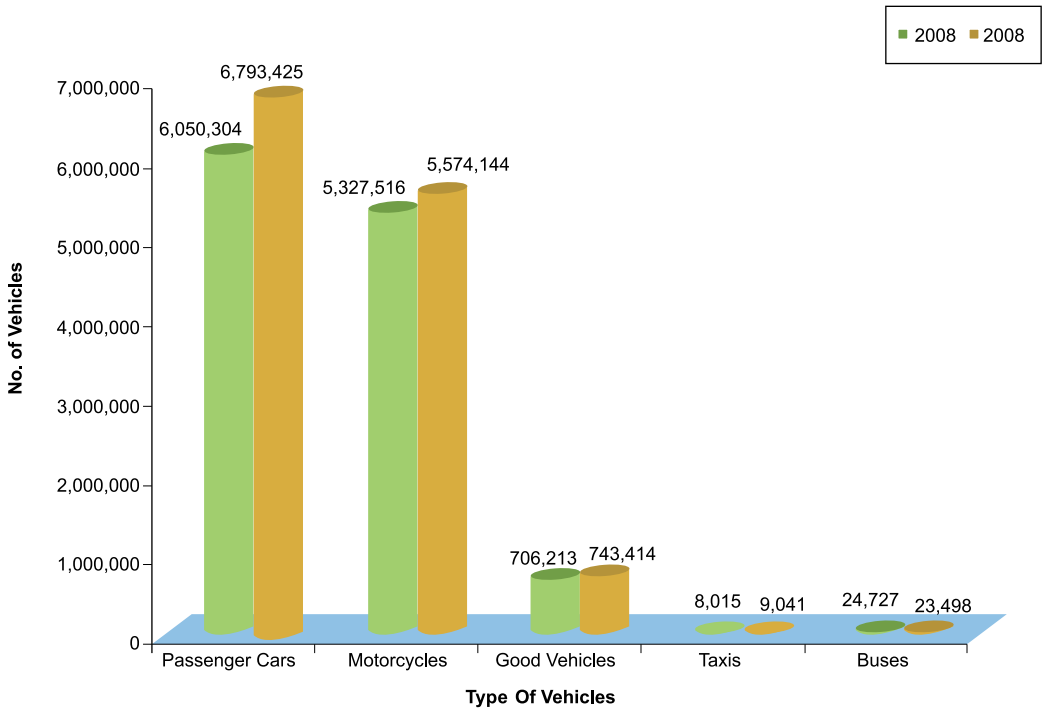


Figure 6.6 Malaysia: Number of In Use Vehicles in 2008-2009
(Source: Road Transport Department, Malaysia, 2009)

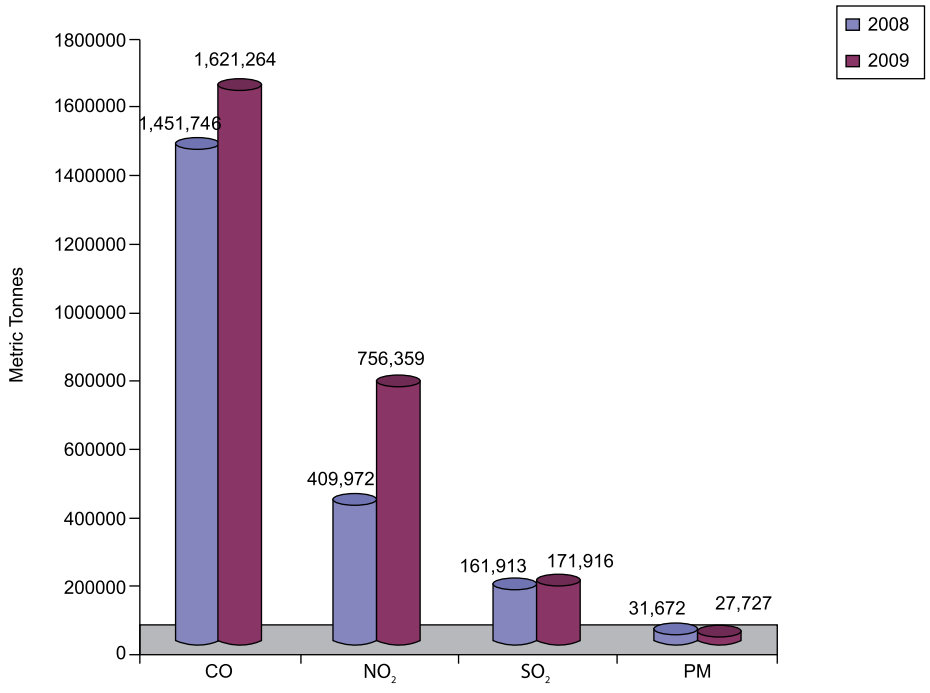


Figure 6.7 Malaysia: Air Pollutant Emission Load from All Sources, 2008-2009
(Source: From National Energy Balance 2007)

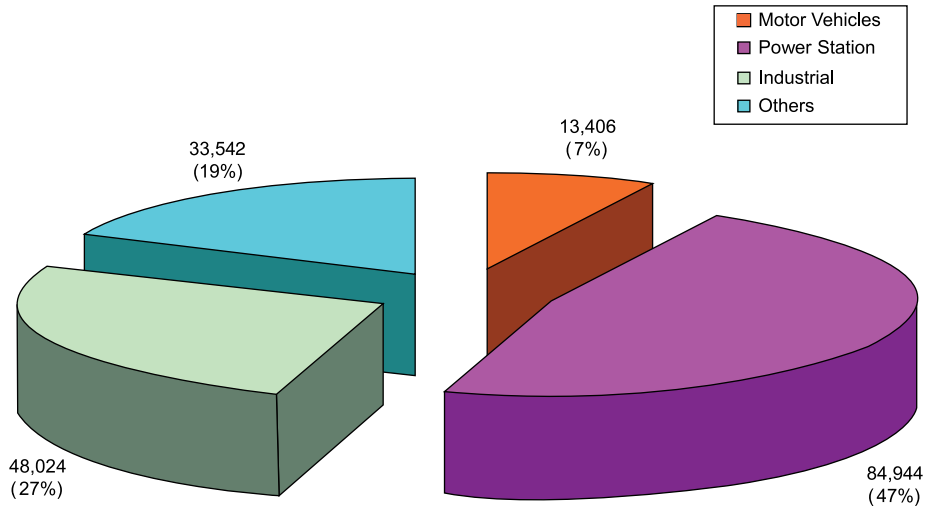


Figure 6.8 Malaysia: SO_2 Emission by Sources (Metric Tonnes), 2009

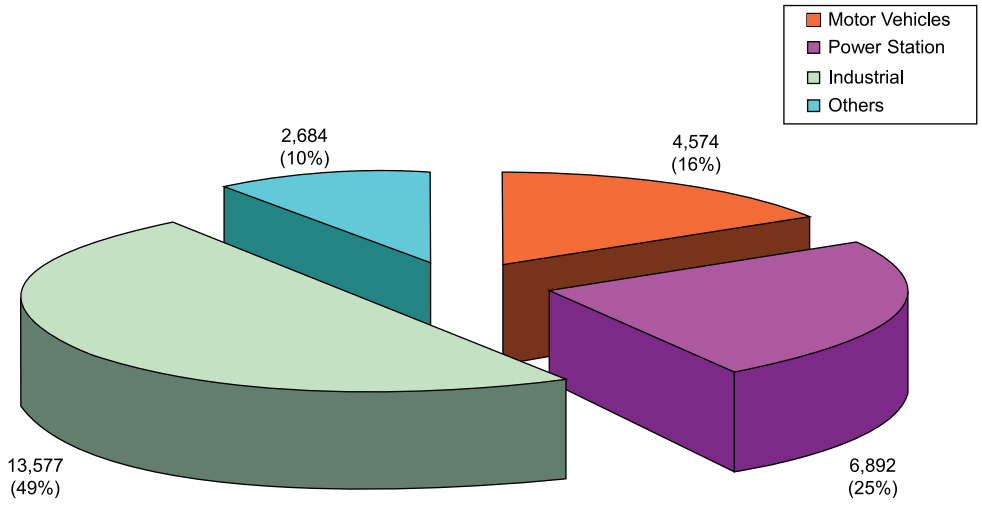


Figure 6.9 Malaysia: Particulate Matter (PM) Emission Load by Sources (Metric Tonnes), 2009

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

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

SCHEDULED WASTES INVENTORY

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

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

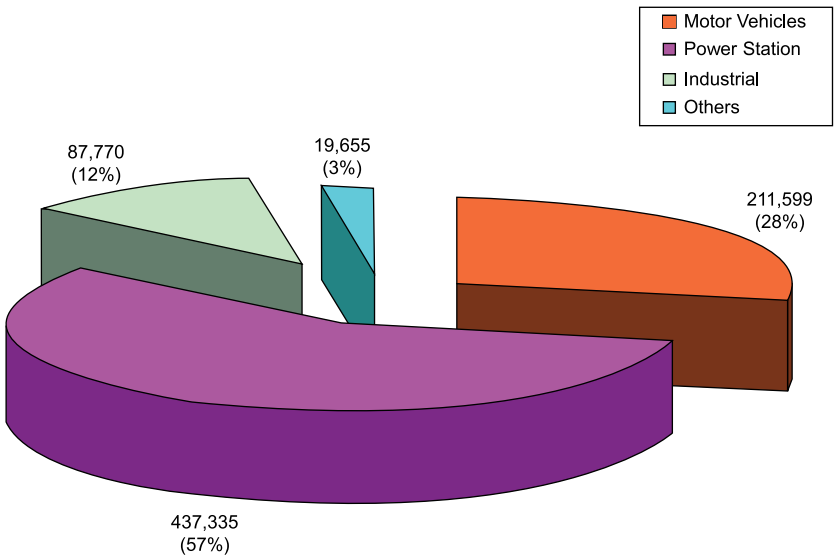


Figure 6.10 Malaysia: NO_2 Emission by Sources (Metric Tonnes), 2009

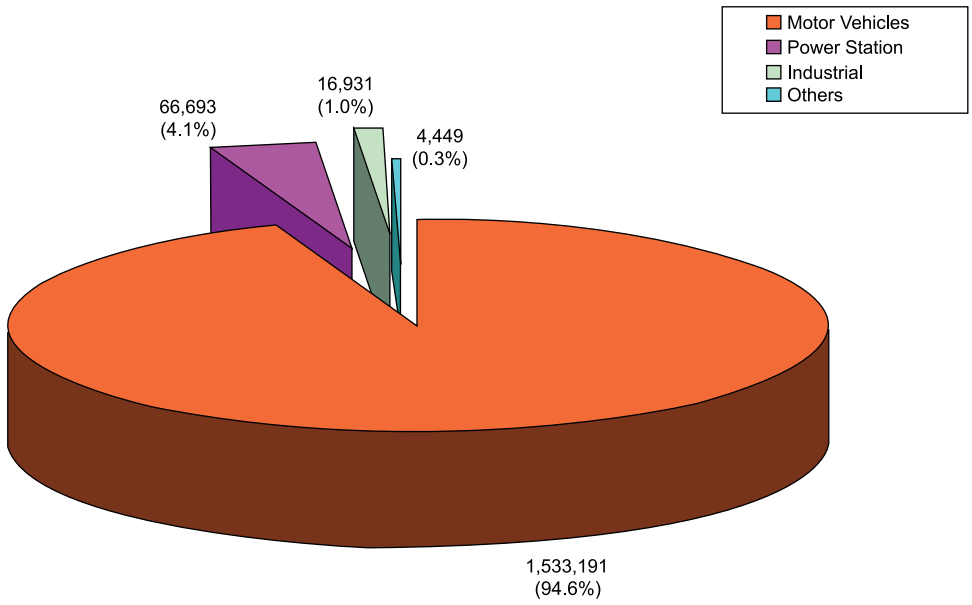


Figure 6.11 Malaysia: CO Emission by Sources (Metric Tonnes), 2009

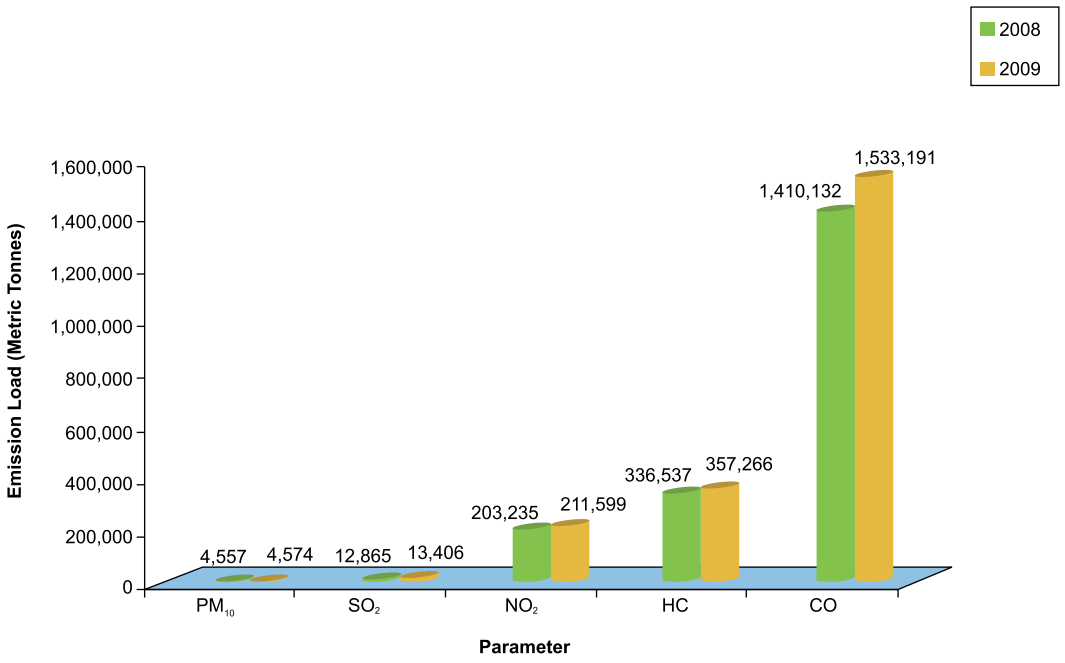


Figure 6.12 Malaysia: Air Pollutant Emission Load from Motor Vehicles, 2008-2009

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

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

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

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

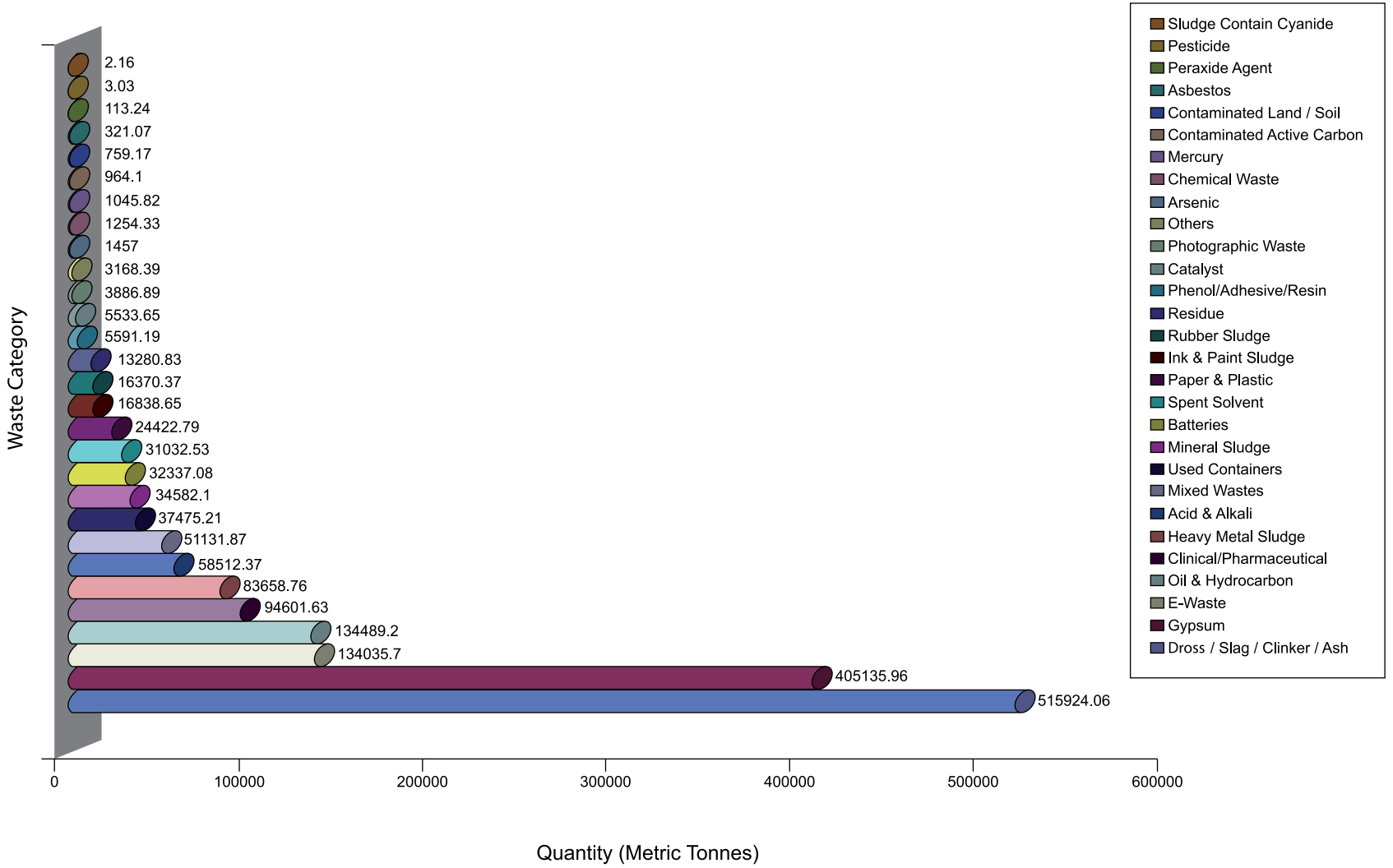


Figure 6.13 Malaysia: Quantity of Scheduled Wasted Generated by Category, 2009

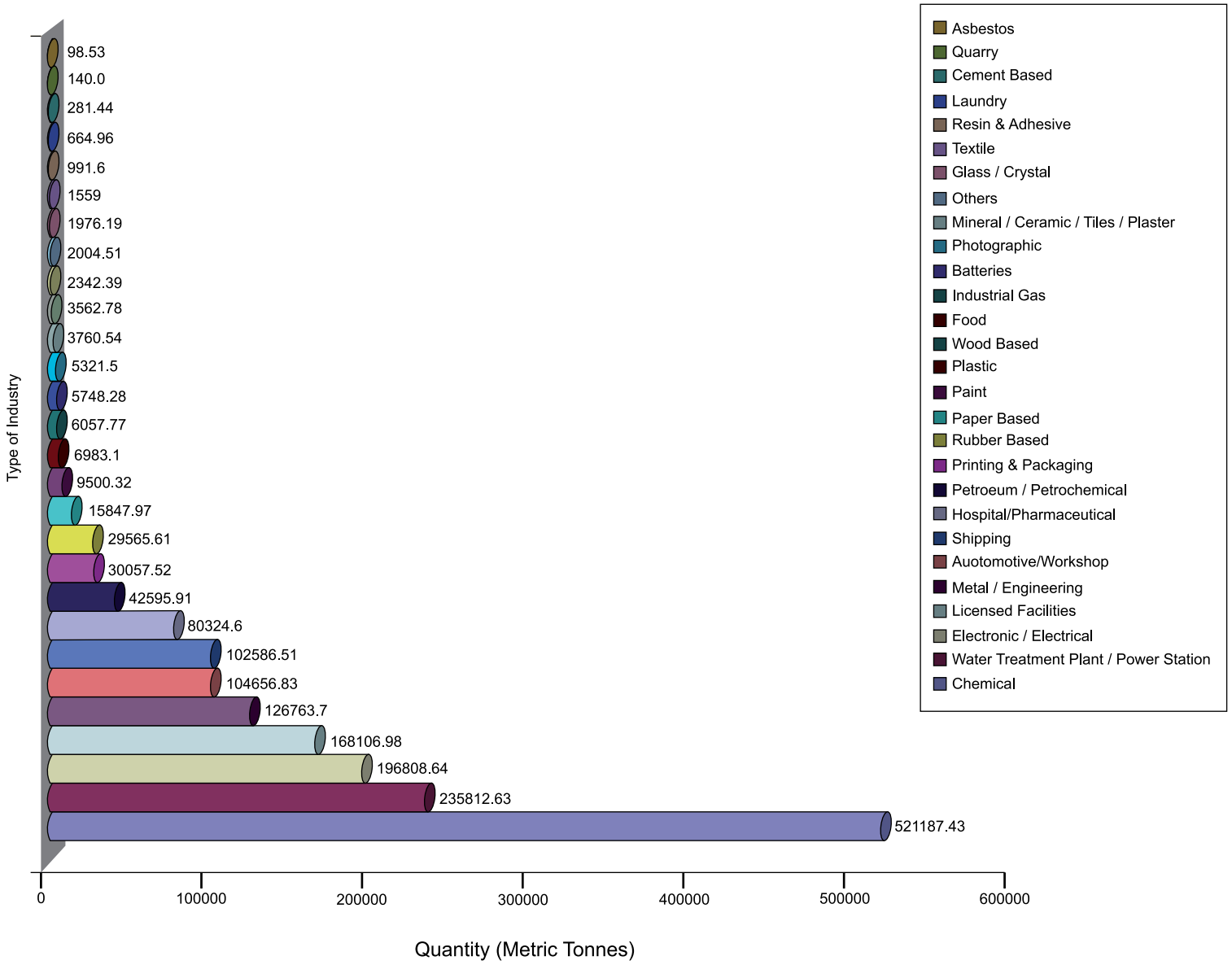


Figure 6.14 Malaysia: Quantity of Scheduled Waste Generated by Industry, 2009

Table 6.4 Malaysia : Facilities Handling Scheduled Wastes, 2009

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

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

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

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

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

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

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

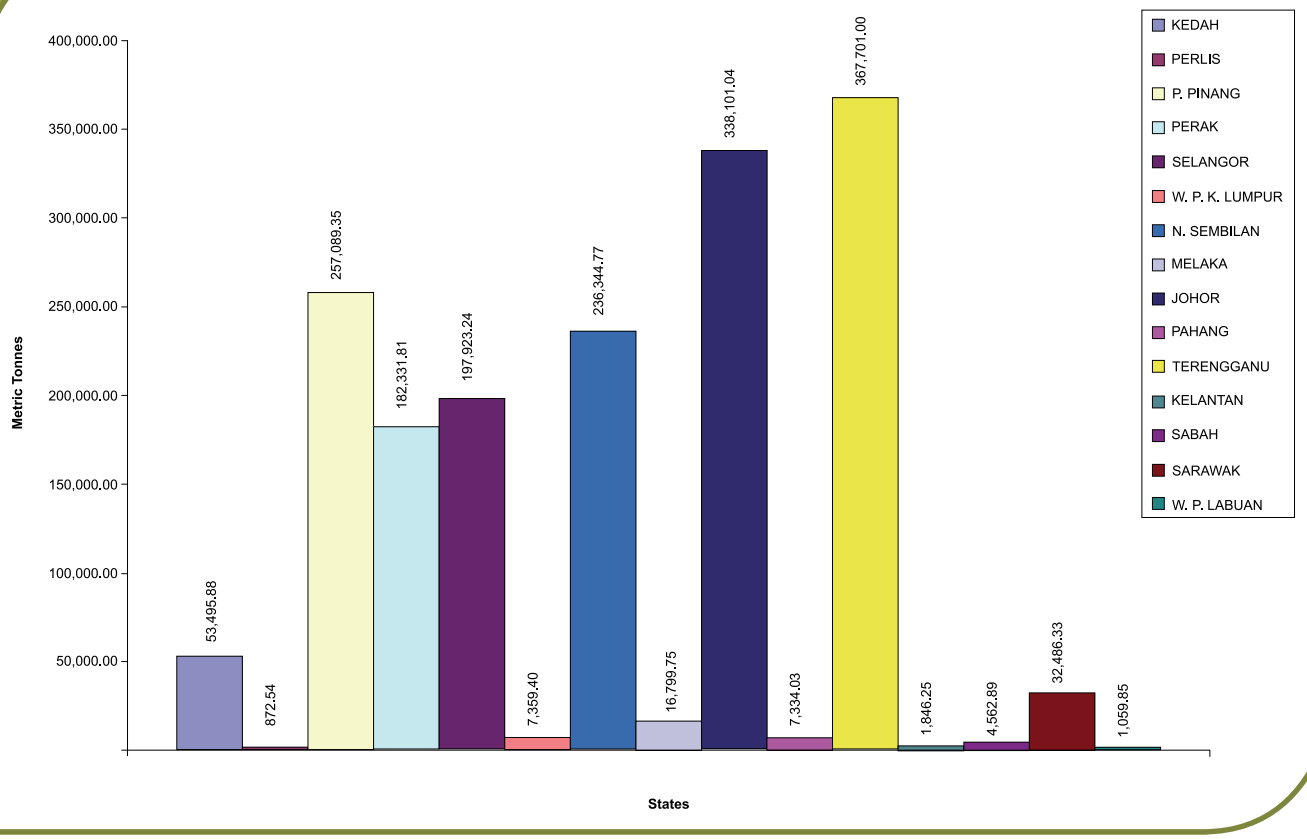


Figure 6.15 Malaysia : Distribution of Scheduled Wastes Generated By State, 2009

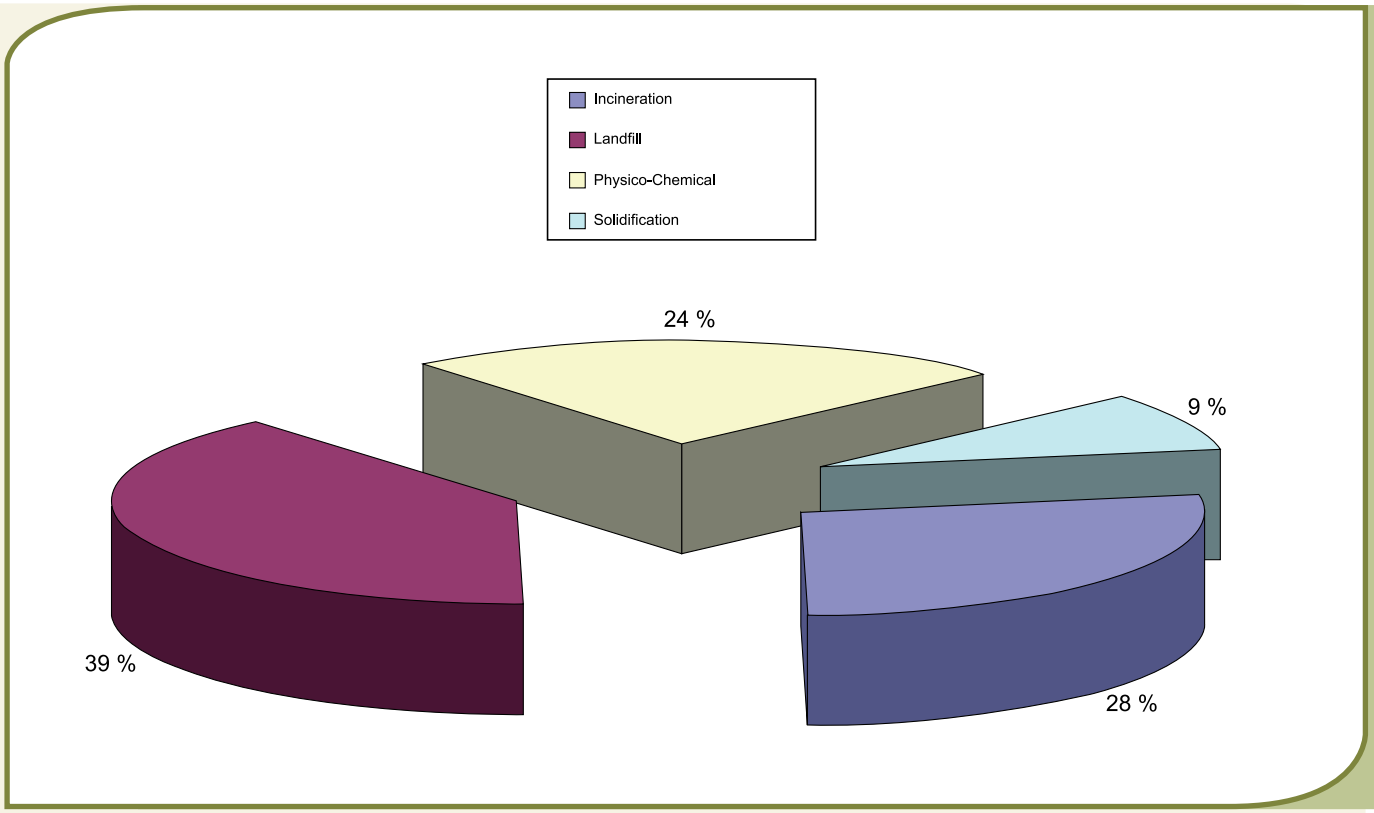


Figure 6.16 Malaysia : Types of Treatment and Disposal of Waste

Electronic Waste : Discarded Mobile Phones and Batteries

Annex

Annex

National Water Quality Standards For Malaysia

PARAMETER	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		-	-	-	
Mg	mg/l		-	-	-	
Na	mg/l		-	-	3 SAR	
K	mg/l		-	-	-	
Fe	mg/l		1	1	1 (Leaf) 5 (Others)	
Pb	mg/l		0.05	0.02* (0.01)	5	L
Mn	mg/l		0.1	0.1	0.2	E
Hg	mg/l	N	0.001	0.004 (0.0001)	0.002	V
Ni	mg/l	A	0.05	0.9*	0.2	E
Se	mg/l	T	0.01	0.25 (0.04)	0.02	L
Ag	mg/l	U	0.05	0.0002	-	S
Sn	mg/l	R	-	0.004	-	
U	mg/l	A	-	-	-	A
Zn	mg/l	L	5	0.4*	2	B
B	mg/l		1	(3.4)	0.8	O
Cl	mg/l	L	200	-	80	V
Cl_2	mg/l	E	-	(0.02)	-	E
CN	mg/l	V	0.02	0.06 (0.02)	-	
F	mg/l	E	1.5	10	1	IV
NO_2	mg/l	L	0.4	0.4 (0.03)	-	
NO_3	mg/l	S	7	-	5	
P	mg/l		0.2	0.1	-	
Silica	mg/l	O	50	-	-	
SO_4	mg/l	R	250	-	-	
S	mg/l		0.05	(0.001)	-	
CO_2	mg/l	A	-	-	-	
Gross-α	Bq/l	B	0.1	-	-	
Gross-β	Bq/l	S	1	-	-	
Ra-226	Bq/l	E	< 0.1	-	-	
Sr-90	Bq/l	N	< 1	-	-	
CCE	µg/l	T	500	-	-	-
MBAS/BAS	µg/l		500	5000 (200)	-	-
O & G (Mineral)	µg/l		40; N	N	-	-
O & G (Emulsified Edible)	µg/l		7000; N	N	-	-
PCB	µg/l		0.1	6 (0.05)	-	-
Phenol	µg/l		10	-	-	-
Aldrin/Dieldrin	µg/l		0.02	0.2 (0.01)	-	-
BHC	µg/l		2	9 (0.1)	-	-
Chlordane	µg/l		0.08	2 (0.02)	-	-
t-DDT	µg/l		0.1	(1)	-	-
Endosulfan	µg/l		10	-	-	-
Heptachlor/Epoxide	µg/l		0.05	0.9 (0.06)	-	-
Lindane	µg/l		2	3 (0.4)	-	-
2,4-D	µg/l		70	450	-	-
2,4,5-T	µg/l		10	160	-	-
2,4,5-TP	µg/l		4	850	-	-
Paraquat	µg/l		10	1800	-	-

Notes :
** = At hardness 50 mg/l $CaCO_3$*
 # = Maximum (unbracketed) and 24-hour average (bracketed) concentrations
N = Free from visible film sheen, discolouration and deposits

National Water Quality Standards For Malaysia

PARAMETER	UNIT	CLASS					
		I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/l	0.1	0.3	0.3	0.9	2.7	> 2.7
Biochemical Oxygen Demand	mg/l	1	3	3	6	12	> 12
Chemical Oxygen Demand	mg/l	10	25	25	50	100	> 100
Dissolved Oxygen	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	-	-	-
Electrical Conductivity*	µS/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	-	Normal + 2 °C	-	Normal + 2 °C	-	-
Turbidity	NTU	5	50	50	-	-	-
Faecal Coliform**	count/100 ml	10	100	400	5000 (20000)[a]	5000 (20000)[a]	-
Total Coliform	count/100 ml	100	5000	5000	50000	50000	> 50000

Notes :
N : No visible floatable materials or debris, no objectional odour or no objectional taste
** : Related parameters, only one recommended for use*
*** : Geometric mean*
a : Maximum not to be exceeded

Water Classes And Uses

CLASS	USES
Class I	Conservation of natural environment. Water Supply I – 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, of economic value and tolerant species; livestock drinking.
Class IV	Irrigation
Class V	None of the above.

DOE Water Quality Classification Based On Water Quality Index

SUB INDEX & WATER QUALITY INDEX	INDEX RANGE		
	CLEAN	SLIGHTLY POLLUTED	POLLUTED
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
Water Quality Index (WQI)	81 - 100	60 - 80	0 - 59

DOE Water Quality Index Classification

PARAMETER	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 Oxygen	mg/l	> 7	5 – 7	3 – 5	1 – 3	< 1
pH	-	> 7.0	6.0 – 7.0	5.0 – 6.0	< 5.0	> 5.0
Total Suspended Solid	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

WQI FORMULA AND CALCULATION

FORMULA

WQI = (0.22 * SIDO) + (0.19 * SIBOD) + (0.16 * SICOD) + (0.15 * SIAN) + (0.16 * SISS) + (0.12 * SIpH)
where;

SIDO = Subindex DO (% saturation)
SIBOD = Subindex BOD
SICOD = Subindex COD
SIAN = Subindex NH_3-N
SISS = Subindex SS
SIpH = Subindex pH
$0 \leq WQI \leq 100$

BEST FIT EQUATIONS FOR THE ESTIMATION OF VARIOUS SUBINDEX VALUES

Subindex for DO (in % saturation)

SIDO = 0 for $x \leq 8$
SIDO = 100 for $x \geq 92$
$SIDO = -0.395 + 0.030x^2 - 0.00020x^3$ for $8 < x < 92$

Subindex for BOD

SIBOD = 100.4 - 4.23x for $x \leq 5$
SIBOD = 108 * exp(-0.055x) - 0.1x for $x > 5$

Subindex for COD

SICOD = -1.33x + 99.1 for $x \leq 20$
SICOD = 103 * exp(-0.0157x) - 0.04x for $x > 20$

Subindex for NH_3-N

SIAN = 100.5 - 105x for $x \leq 0.3$
SIAN = 94 * exp(-0.573x) - 5 * | x – 2 | for $0.3 < x < 4$
SIAN = 0 for $x \geq 4$

Subindex for SS

SISS = 97.5 * exp(-0.00676x) + 0.05x for $x \leq 100$
SISS = 71 * exp(-0.0061x) - 0.015x for $100 < x < 1000$
SISS = 0 for $x \geq 1000$

Subindex for pH

$SIpH = 17.2 - 17.2x + 5.02x^2$ for $x < 5.5$
$SIpH = -242 + 95.5x - 6.67x^2$ for $5.5 \leq x < 7$
$SIpH = -181 + 82.4x - 6.05x^2$ for $7 \leq x < 8.75$
$SIpH = 536 - 77.0x + 2.76x^2$ for $x \geq 8.75$

*Note: * means multiply with*

NOTES

NOTES