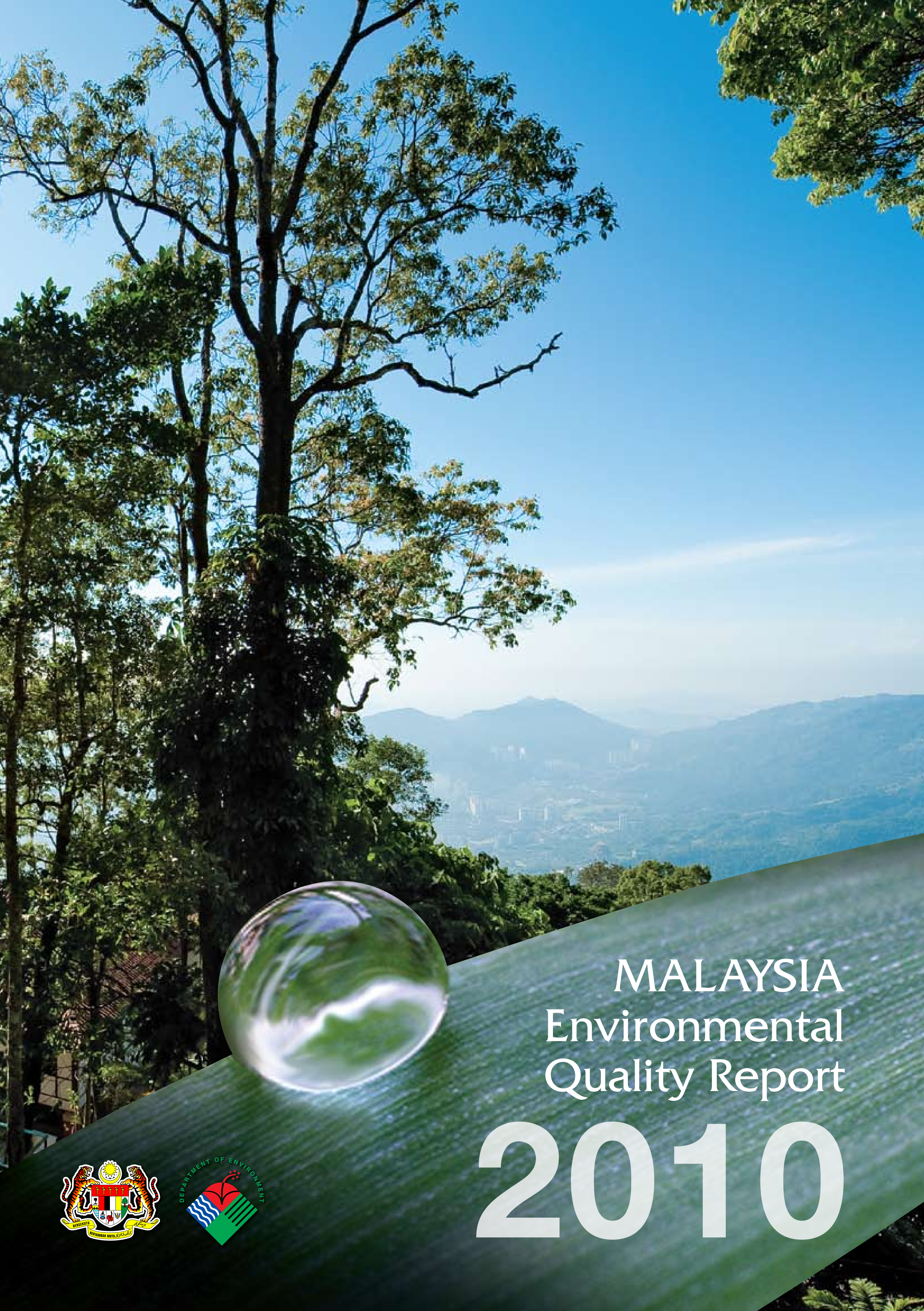

MALAYSIA Environmental Quality Report 2010

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Foreword

It is my duty to present the Environmental Quality Report 2010 as required under Section 3(1)(i) of the Environmental Quality Act 1974.

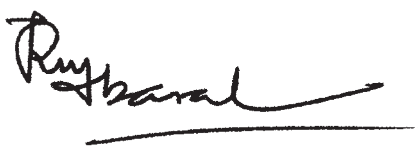
Air quality remained good to moderate most of the time in 2010. There was a slight improvement in the air quality as indicated by the increased in the number of good air quality days in 2010 at 63% compared to 56% in 2009. However, the southern ASEAN region including the southern part of Peninsular Malaysia experienced a short haze episode in October from transboundary haze pollution due to the escalating land and forest fires in Sumatera. This also resulted in all schools in Muar District and other schools in the nearby Districts to be closed on 21st October 2010 when the API exceeded 400.

Compared to 2009, there was a slight deterioration in river water quality. There was a reduction in the number of clean rivers compared with 2009. There were 293 clean rivers in 2010 as compared with 306 in 2009. The number of slightly polluted rivers decreased from 217 in 2009 to 203 while the number of polluted rivers increased to 74 from 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).

While the Department of Environment will take innovative measures to ensure regulatory compliance, no effort will be spared to enhance public environmental awareness and overcome apathy towards safeguarding the environment.

"Environmental Conservation, Our Shared Responsibility"

With best wishes,



Dato' Hajah Rosnani Ibarahim
Director General of Environmental Quality
Malaysia

30 July 2011

CHAPTER 1
AIR QUALITY

Air Quality

AIR QUALITY MONITORING

The Department of Environment (DOE) monitors the country's ambient air quality through a network of 52 continuous monitoring stations (**Map 1.1 and Map 1.2**). These monitoring stations are strategically located in urban, suburban and industrial areas to detect any significant change in the air quality which may be harmful to human health and the environment.

In addition to the 52 stations in the National Continuous Air Quality Monitoring Network, manual air quality monitoring stations using High Volume Samplers were also established at 14 different sites for measuring total suspended particulates, particulate matter (PM_{10}) and heavy metals such as lead.

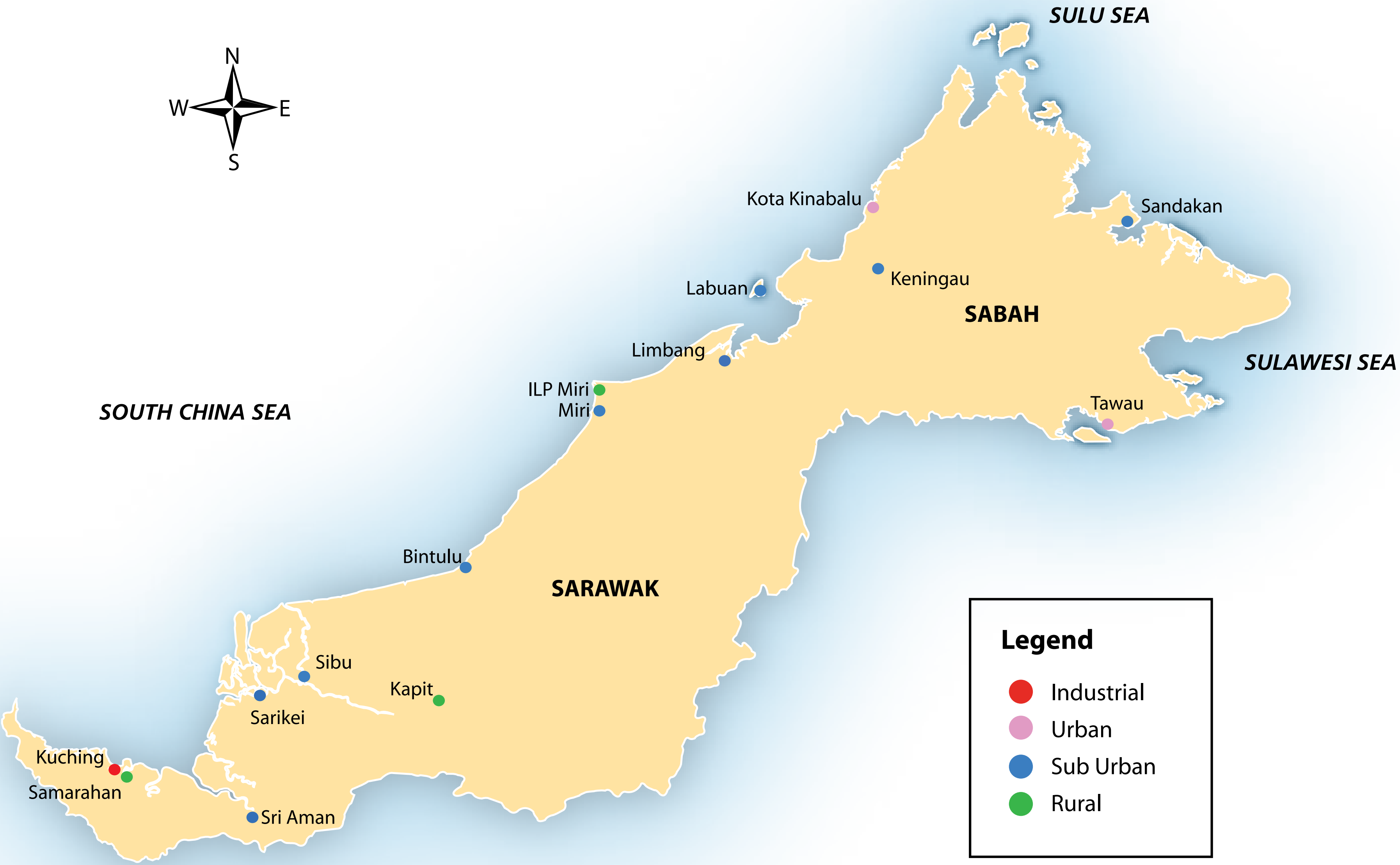
Scenic view of Putrajaya

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

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, 2010



Map 1.2 Malaysia: Location of Continuous Air Quality Monitoring Stations East Malaysia, 2010

AIR QUALITY STATUS

Based on the Air Pollutant Index (API), the overall air quality for Malaysia in 2010 was between good to moderate levels most of the time. The overall number of good air quality days increased in 2010 (63 percent of the time) compared to that in 2009 (56 percent of the time) while remaining 36 percent at moderate level and 1.0 percent at unhealthy level. However, peatland fires resulting in transboundary air pollution that occurred in the Southern ASEAN Region in the month of October resulted in a short spell of haze episode in the southern part of Peninsular Malaysia. Thus, high level of PM_{10} was recorded in the southern part of the country particularly in the states of Johor, Melaka and Negeri Sembilan for a short period of 3 to 4 days in October.

Clear blue sky indicating good air quality

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: ** in mg/m^3

Relatively, 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 and Johor.

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 central business areas with heavy traffic volume.

The daily concentrations of PM_{10} in Klang for 2010 had significantly improved compared to 2009 due to the implementation of the Fire Prevention and Peatland Management Programme conducted by the DOE at Johan Setia, Klang and also due to the wetter weather conditions in this area. **(Figure 1.1(c))**. On the contrary, the southern part of Peninsular Malaysia particularly in Muar, Johor experienced a short spell of severe transboundary haze episodes that resulted in all schools in Muar district and certain affected schools in Johor to be closed on 21st of October 2010 when the API reading exceeded 400 **(Figure 1.1(d)).** The land and forest fires in the Riau Province of Central Sumatera, Indonesia had been reported by the ASEAN Specialised Meteorological Center (ASMC) as the primary cause of transboundary haze pollution during this period. Apart from that, the daily concentrations of PM_{10} in other areas were all in compliance with the Malaysian Ambient Air Quality Guidelines.

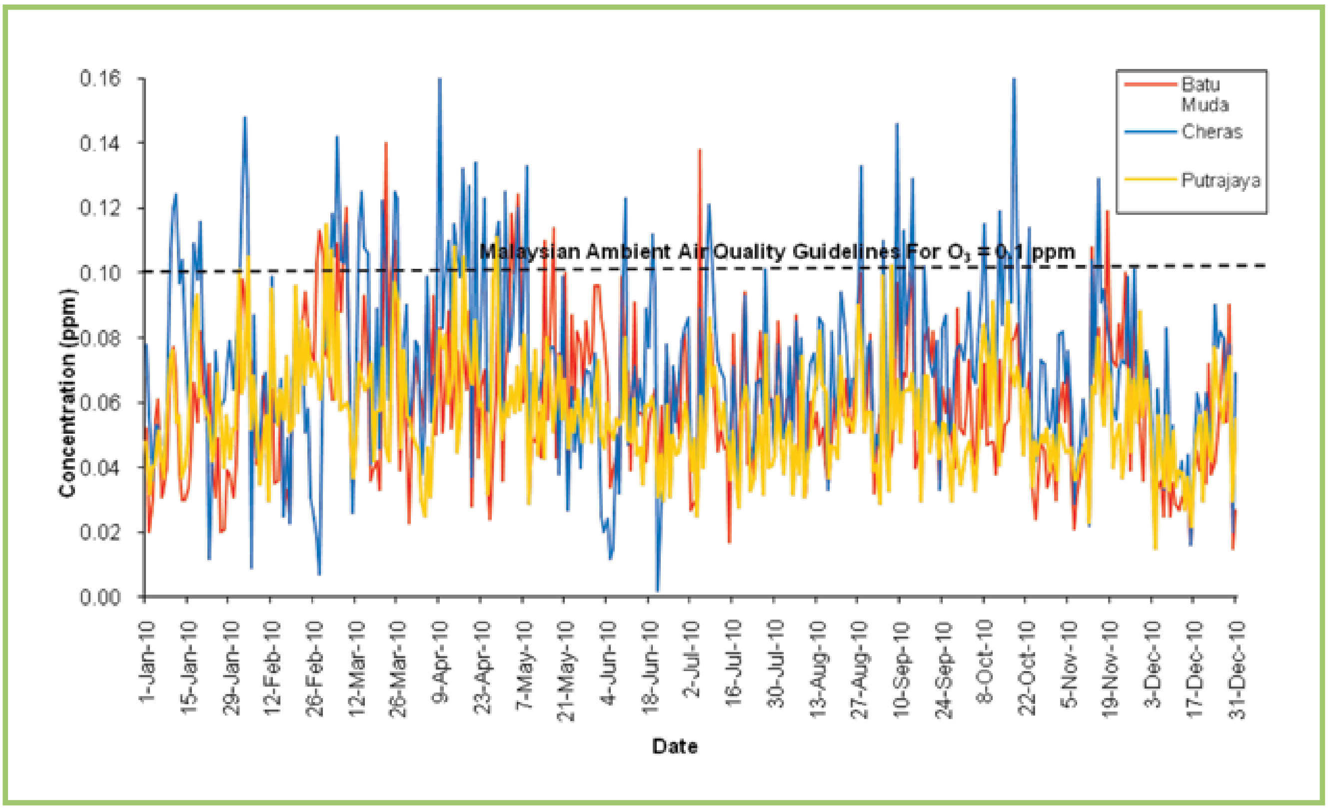


Figure 1.1(a) Malaysia: Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Klang Valley, 2010

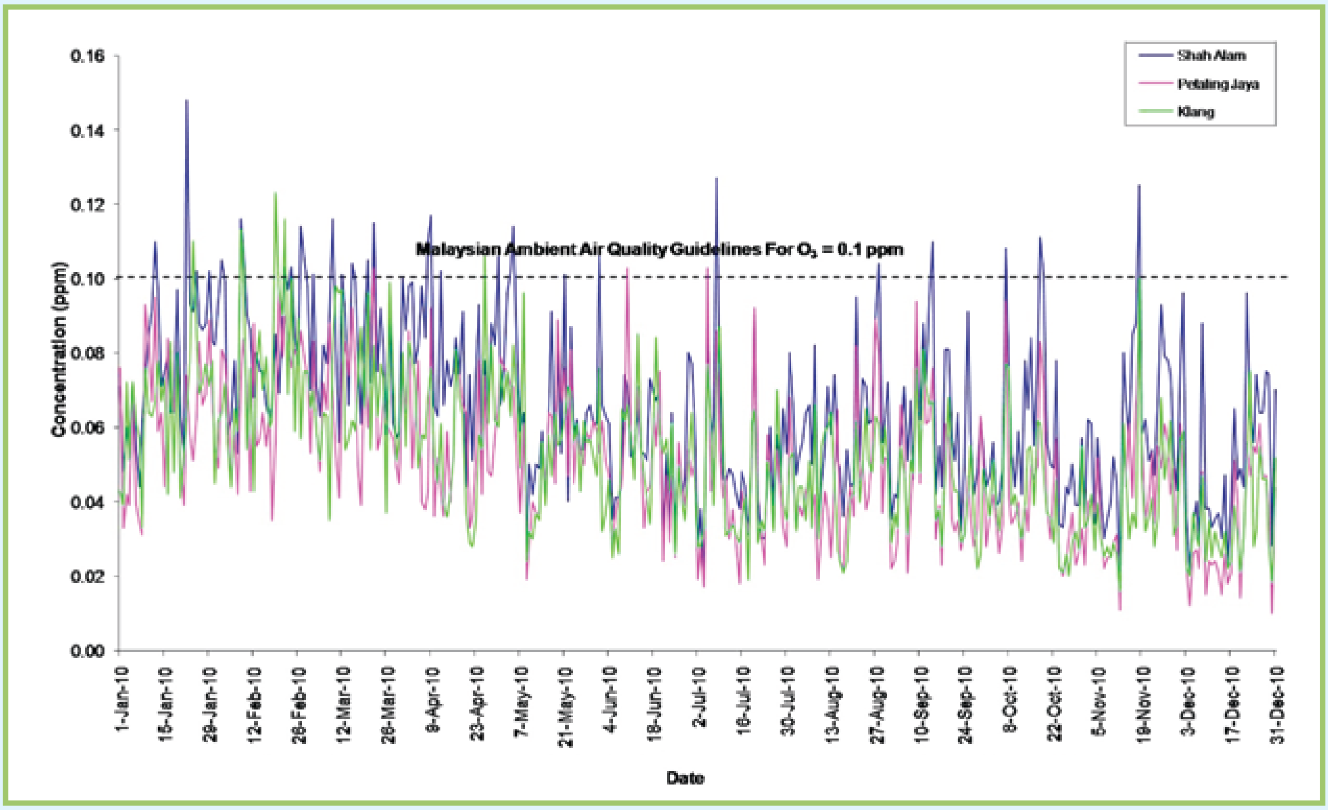


Figure 1.1(b) Malaysia: Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Klang Valley, 2010

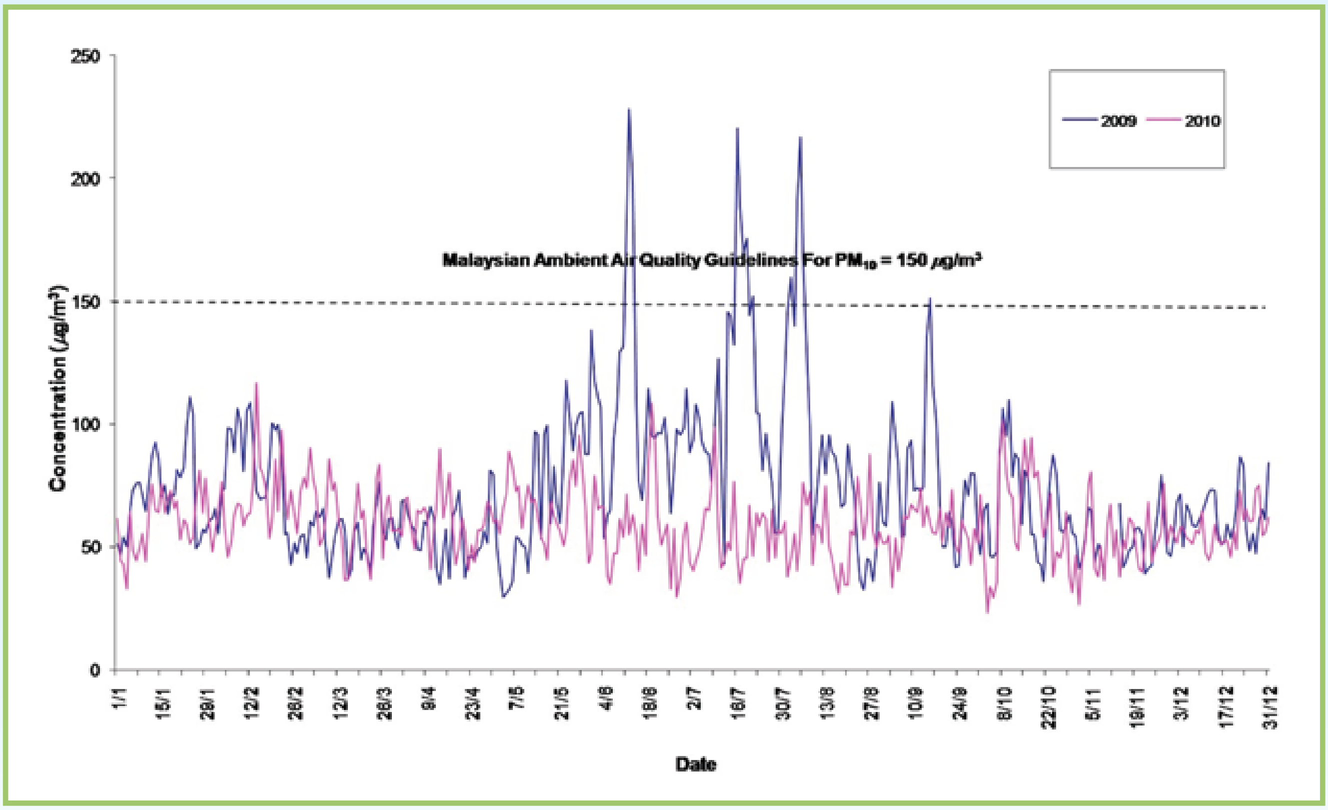


Figure 1.1(c) Malaysia: Trend of 24-hour Concentration of Particulate Matter (PM_{10}), Klang, 2009 and 2010

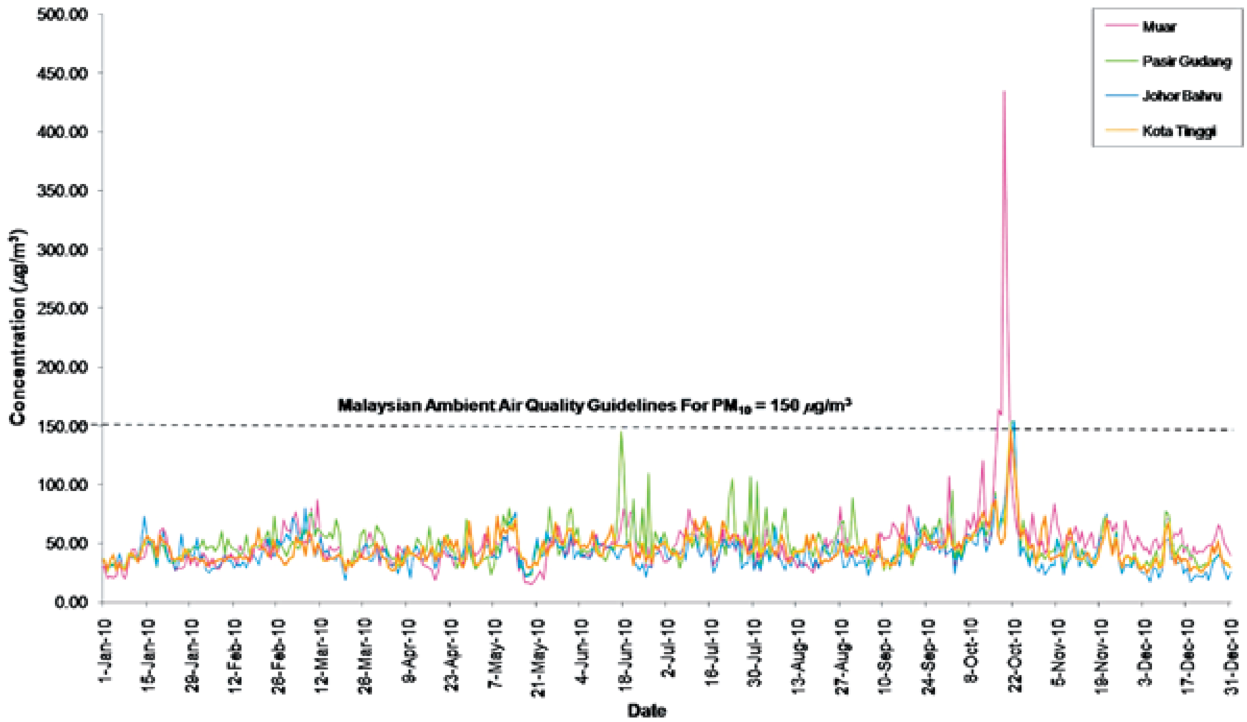
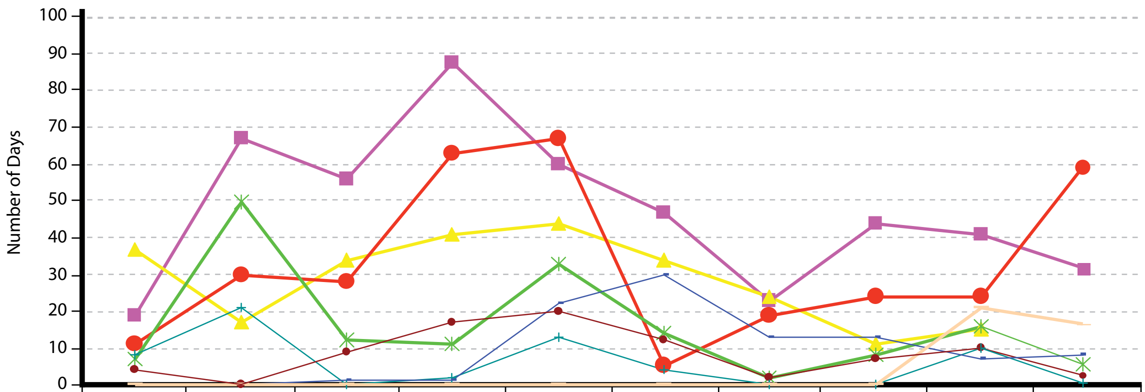


Figure 1.1(d) Malaysia: Trend of 24-hour Concentration of Particulate Matter (PM_{10}), South Peninsular Malaysia, 2010



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Shah Alam	19	67	56	88	60	47	23	44	41	32
Banting*	-	-	-	-	-	-	-	-	-	0
Cheras	11	20	28	63	67	5	19	24	24	59
Klang	7	50	12	11	33	14	2	8	16	6
Petaling Jaya	4	0	9	17	20	12	2	7	10	3
Kuala Selangor	8	21	0	2	13	4	0	0	10	0
Putrajaya	-	-	1	1	22	30	13	13	7	8
Batu Muda	-	-	-	-	-	-	-	-	21	17

Note: Reading base on daily Maximum API

** Previous station in Kajang was replaced with Banting and started operation in March 2010*

Figure 1.1 Malaysia: Number of Unhealthy Days, Klang Valley, 2001 - 2010

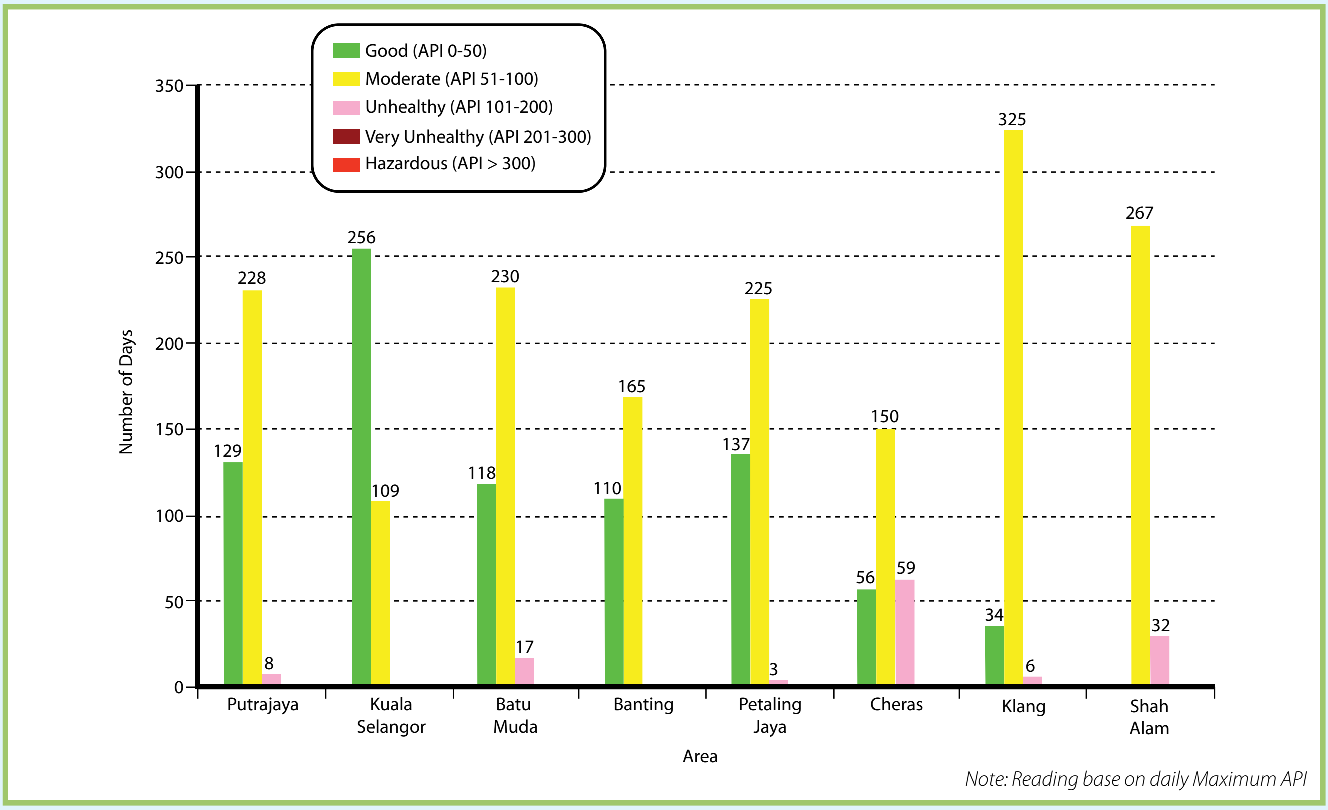


Figure 1.2 Malaysia: Klang Valley Air Quality Status, 2010

Air Quality Status in the West Coast

Klang Valley

In 2010, the air quality in the Klang Valley was good 33 percent of the time, moderate 62 percent and the remaining five (5) percent was at an unhealthy level. The most number of unhealthy days were recorded in Cheras, Kuala Lumpur (59 days) as compared to 24 days in 2009. The unhealthy days recorded were mostly due to the ground level Ozone (O_3). The number of unhealthy days in Shah Alam, Klang and Petaling Jaya had decreased in 2010 compared to in 2009. No unhealthy day was recorded in Kuala Selangor in 2010 as compared to 10 unhealthy days in 2009 (**Figure 1.1**). 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 Peninsular Malaysia (Perlis, Kedah, Pulau Pinang and Perak), was between good to moderate most of the time. However, Tanjung Malim and Tasek recorded 4 unhealthy days and 1 unhealthy day, respectively. The pollutants of concerned were ground level Ozone (O_3) and particulate matter (PM_{10})

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 (8 days), Pasir Gudang (8 days), Nilai (5 days), Seremban (4 days), Bandaraya Melaka (3 days), Muar (3 days), Larkin (3 days) and Bukit Rambai (2 days). However, Muar recorded 2 days of hazardous air quality due to transboundary haze pollution contributed by land and forest fires in Central Sumatera, Indonesia. 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.

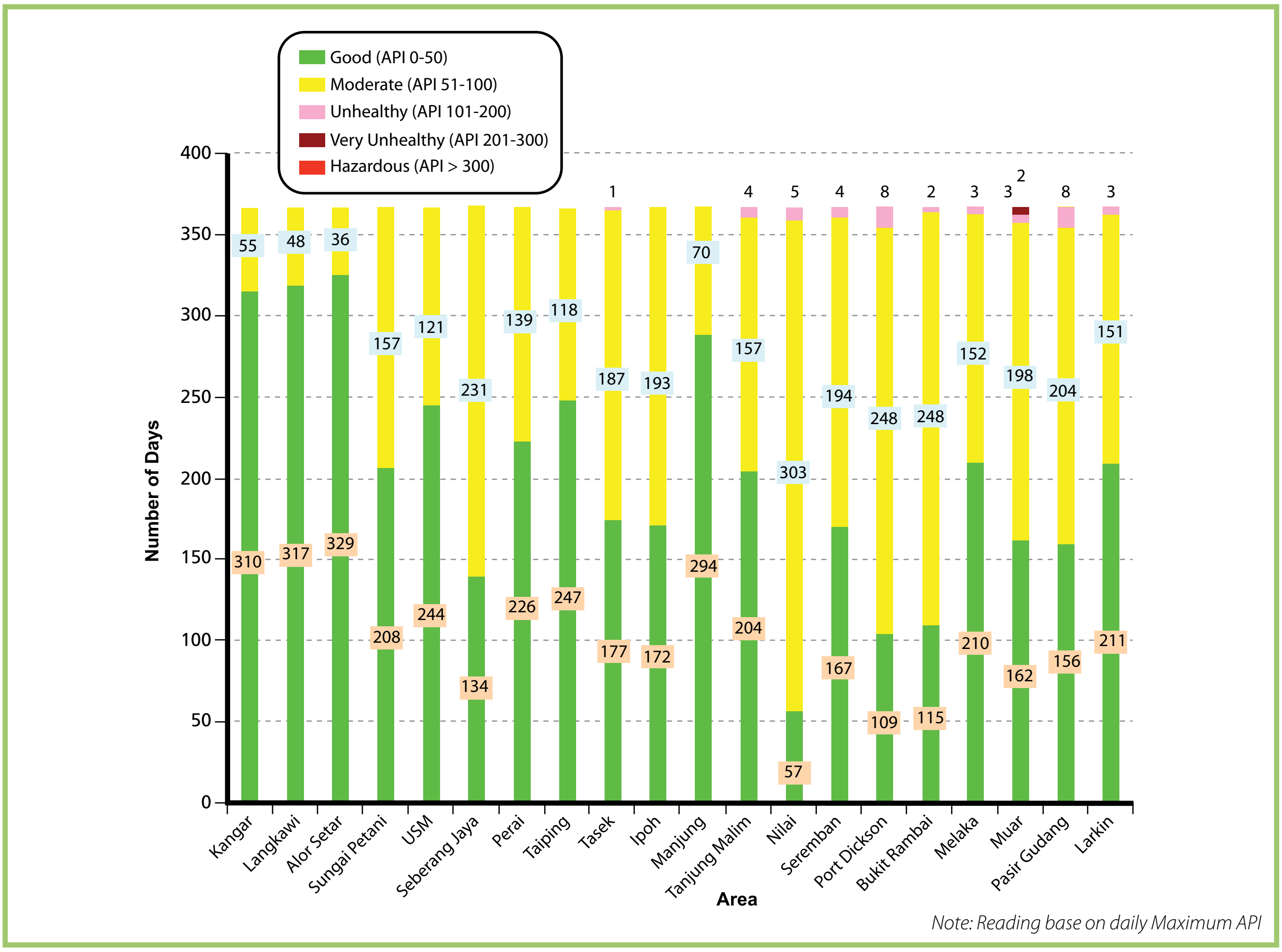


Figure 1.3 Malaysia: Air Quality Status, West Coast Peninsular Malaysia, 2010

Air Quality Status in the East Coast

In the East Coast of Peninsular Malaysia (Pahang, Terengganu, Kelantan and East Johor) the air quality remained good most of the time and occasionally moderate. Balok Baru in Pahang which is located in an industrial and peat land area recorded 3 unhealthy days due to high level of particulate matter (PM_{10}) and Kota Tinggi in Johor recorded 3 unhealthy days due the transboundary haze pollution from Central Sumatera, Indonesia. 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. There was no unhealthy day recorded in 2010 in these areas compared to 66 unhealthy days in 2009 due to the wetter weather conditions in the year. The overall air quality status in Sabah, Labuan and Sarawak is shown in **Figure 1.5.**

AIR QUALITY TREND

Five (5) air pollutants, namely Particulate Matter (PM_{10}), Ozone (O_3), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO) were monitored continuously at 52 locations. The air quality trend for the period of 1999 to 2010 was computed by averaging direct measurements from the monitoring site on a yearly basis and cross-reference with Malaysia Ambient Air Quality Guidelines as shown in **Table 1.2**.

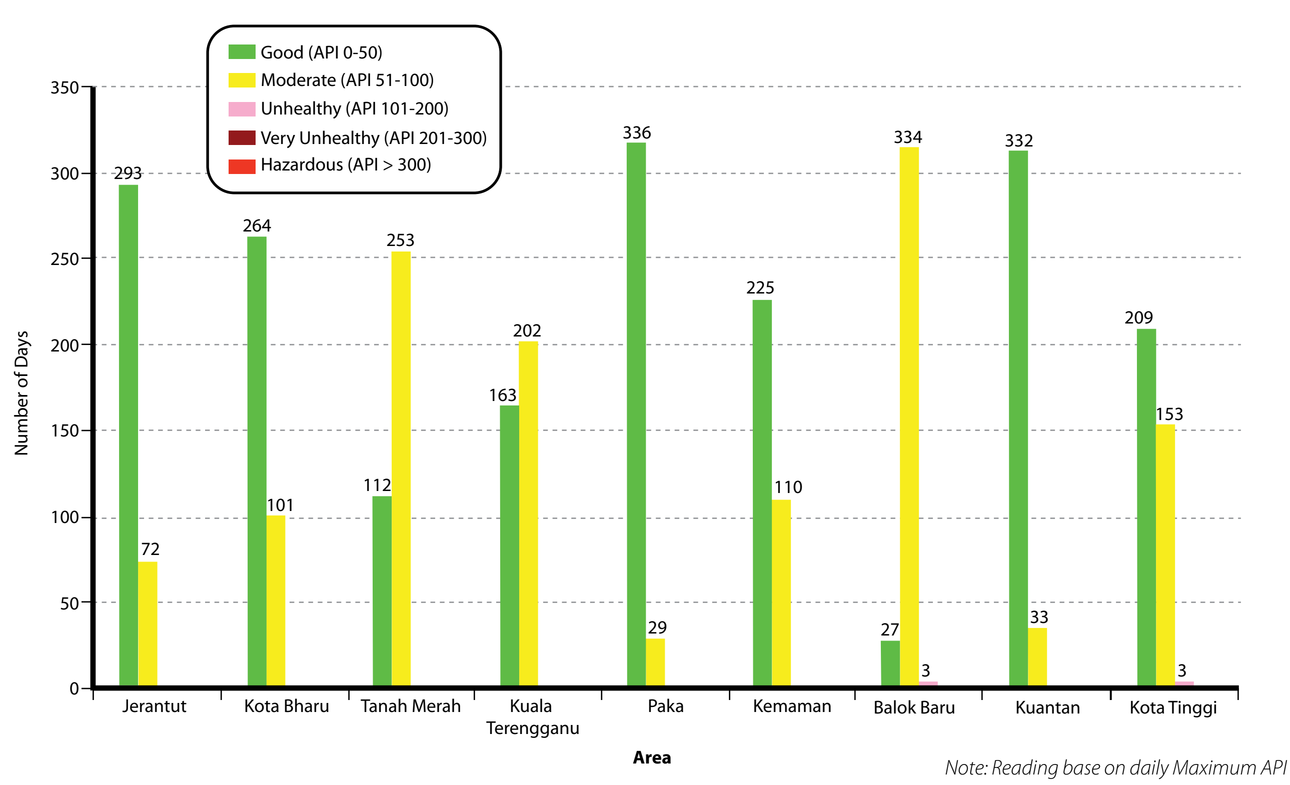


Figure 1.4 Malaysia: Air Quality Status, East Coast Peninsular Malaysia, 2010

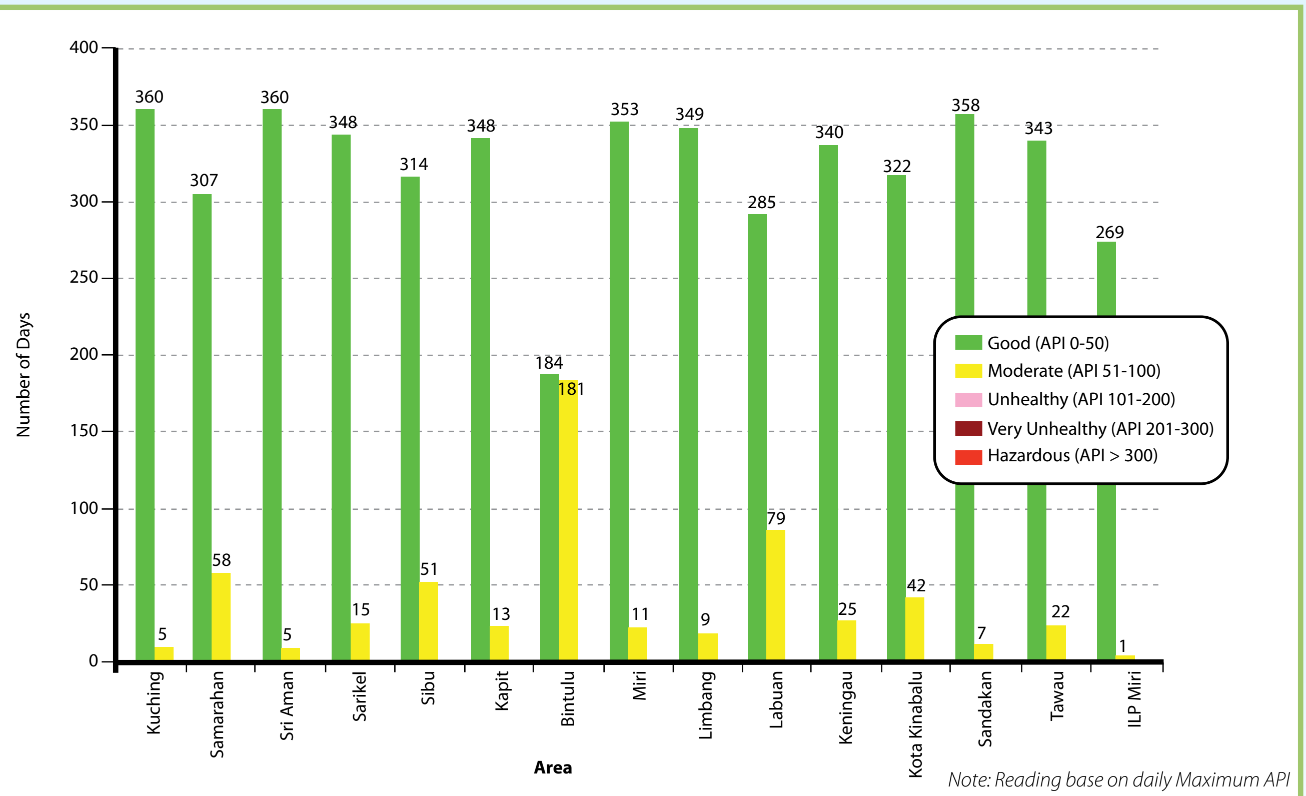


Figure 1.5 Malaysia: Air Quality Status in Sabah, Labuan and Sarawak, 2010

Particulate Matter (PM_{10})

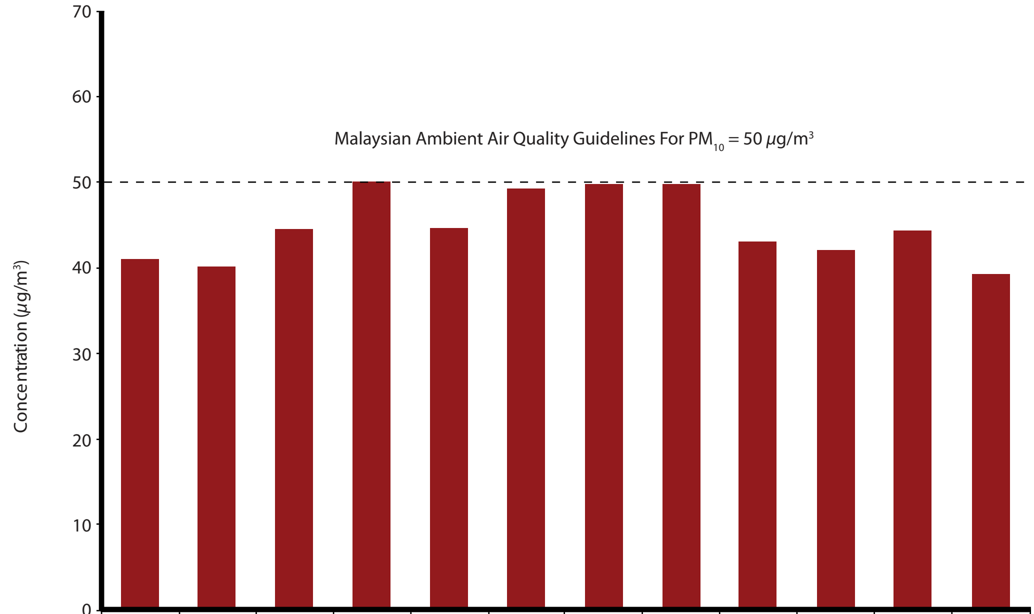
In 2010, the annual average value of PM_{10} in the ambient air was 39 µg/m³ which is below the Malaysian Ambient Air Quality Guidelines value of 50 µg/m³. There was some improvement on the annual average of PM_{10} compared to 2009 which was 44 µg/m³. Transboundary haze had contributed to the higher PM_{10} recorded intermittently in several areas in Johor and Melaka in October 2010.

The trend of the annual average levels of PM_{10} concentration in the ambient air between 1999 and 2010 complied to the Malaysian Ambient Air Quality Guidelines as shown in **Figure 1.6**. Based on land use categories, PM_{10} concentration was in compliance with Malaysian Ambient Air Quality Guidelines as shown in **Figure 1.6(a)**.

Ground Level Ozone (O_3)

In 2010, the annual average daily maximum O_3 concentrations increased by 10 percent compared to 2009. However, the annual average daily maximum one-hour O_3 concentrations in ambient air for 1999 to 2010 were well below the limit of 0.1 ppm as stipulated in the Malaysian Ambient Quality Guidelines as shown in **Figure 1.7**.

Figure 1.7(a) shows the O_3 concentration for various land use categories between 1999 and 2010. Urban areas recorded higher levels of ozone due to higher traffic volume and a conducive atmospheric condition resulting in its formation.



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Concentration	41	40	44	50	44	48	49	49	43	42	45	39
Number of Sites	45	50	50	50	51	51	51	51	51	51	51	52

Figure 1.6 Malaysia: Annual Average Concentration of Particulate Matter (PM_{10}), 1999 - 2010

Kuala Lumpur city on a clear bright day

Sulphur Dioxide (SO_2)

Generally, the annual average SO_2 concentration shows a declining trend between 1999 and 2010 (**Figure 1.8**). It is well below the limit of 0.04 ppm as stipulated in the Malaysian Ambient Air Quality Guidelines. This could be attributed to the use of better fuel quality EURO-2M, stricter enforcement by the DOE as well as more widely use of natural gas for industrial combustion process and vehicles. **Figure 1.8(a**) shows the annual average concentrations of sulphur dioxide for different categories of land use.

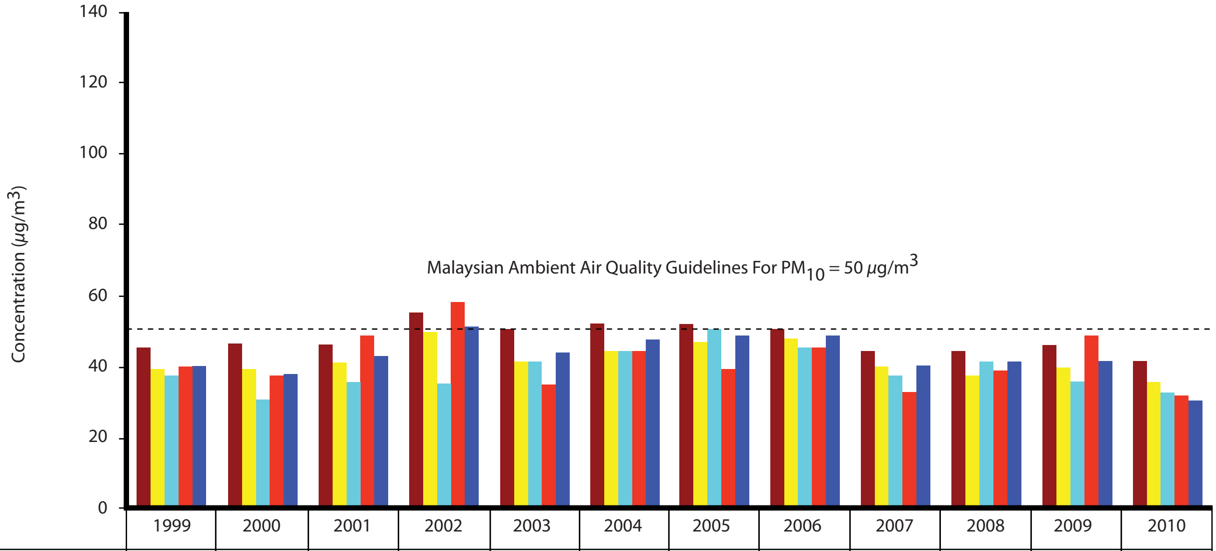
Nitrogen Dioxide (NO_2)

In 2010, there was no significant change of NO_2 concentration compared to the 2009 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 processes. Estimate on NO_2 emission load indicates 61 percent was from power plants while 29 percent from motor vehicles, seven (7) percent from industries and three (3) percent from other sources.

The annual average concentrations of NO_2 in the ambient air from 1999 to 2010 remains almost constant and well below the Malaysian Ambient Air Quality Guidelines. (**Figure 1.9** and **Figure 1.9(a)**)

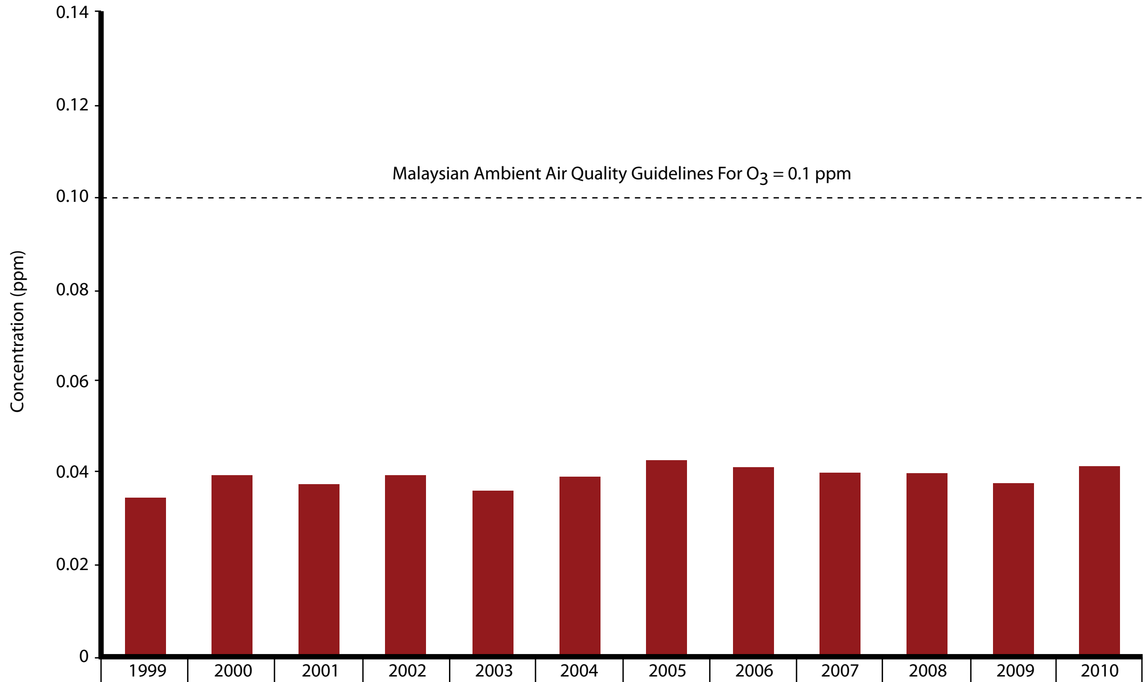
Carbon Monoxide (CO)

There was a slight improvement in the air quality where CO level had decreased by four (4) percent in 2010 compared to 2009. However, the trend of CO concentration from 1999 to 2010 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 2010. **Figure 1.10(a)** shows CO concentrations for various categories of land use.



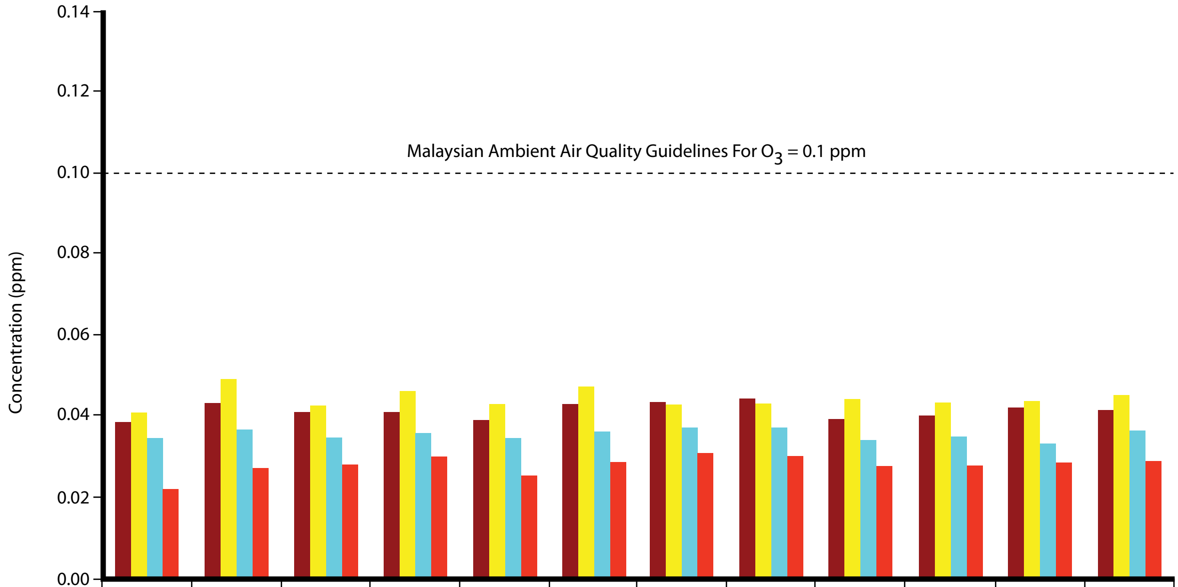
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Urban	45	46	46	55	50	52	52	50	44	44	46	42
Sub Urban	39	39	42	49	42	44	46	47	40	37	40	36
Background	38	31	36	35	42	44	50	45	38	42	36	34
Rural	40	38	48	58	35	44	39	45	33	39	48	30
Mean	40.5	38.5	43.0	49.3	42.3	46	46.8	46.8	38.8	40.5	42.5	35.5

Figure 1.6(a) Malaysia: Annual Average Concentration of Particulate Matter (PM_{10}) by Land Use, 1999-2010



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Concentration	0.034	0.039	0.037	0.0382	0.0353	0.0388	0.0421	0.0408	0.039	0.0392	0.0368	0.0406
Number of Sites	35	39	39	39	41	41	41	41	41	41	44	44

Figure 1.7 Malaysia: Annual Average Daily Maximum 1 Hour Concentration of Ozone (O_3) 1999-2010

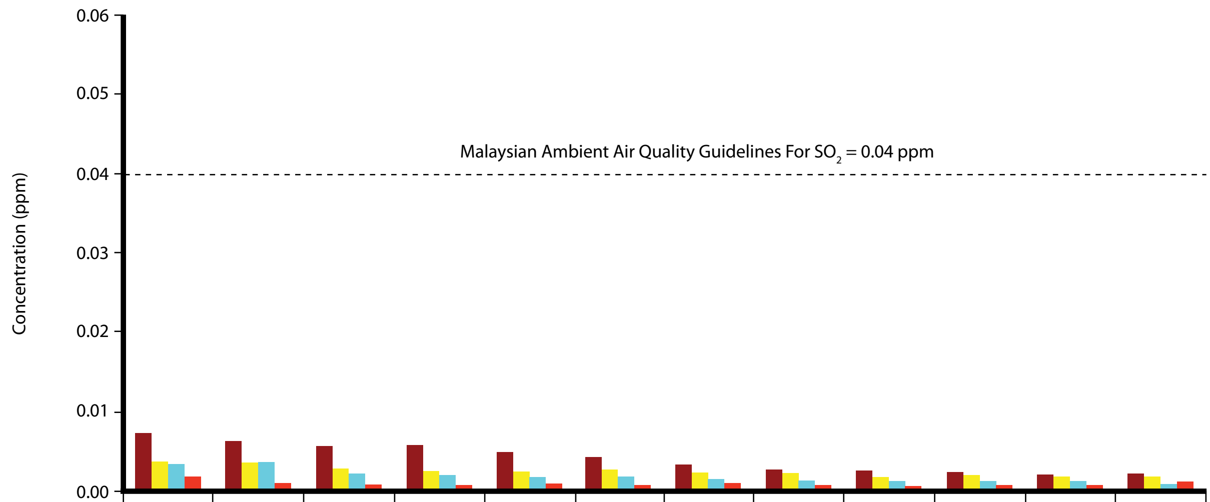


	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Industrial	0.0380	0.0430	0.0405	0.0413	0.0389	0.0429	0.0431	0.0440	0.0391	0.0399	0.0418	0.0412
Urban	0.0410	0.0490	0.0426	0.0461	0.0428	0.0471	0.0428	0.0429	0.0441	0.0435	0.0437	0.0453
Sub Urban	0.0340	0.0370	0.0348	0.0355	0.0345	0.0363	0.0373	0.0371	0.0341	0.0351	0.0331	0.0364
Background	0.0220	0.0270	0.0279	0.0298	0.0250	0.0287	0.0311	0.0300	0.0277	0.0278	0.0284	0.0287

Figure 1.7(a) Malaysia: Annual Average Daily Maximum 1 Hour Concentration of Ozone (O_3) by Land Use, 1999-2010

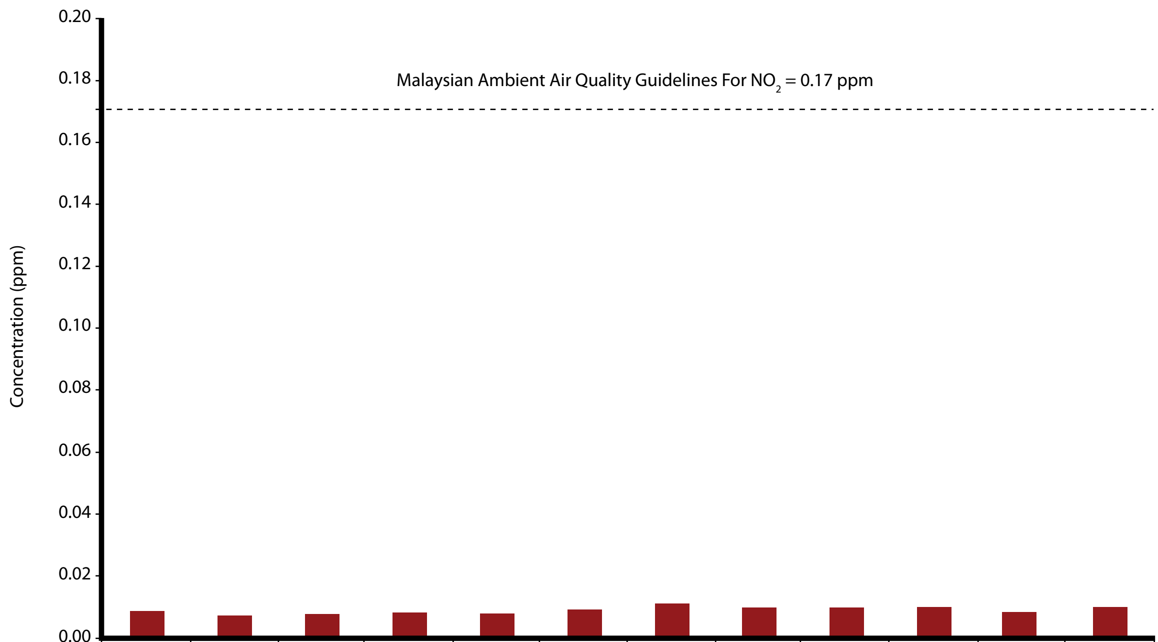
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Concentration	0.0035	0.0038	0.003	0.0029	0.0026	0.0023	0.0024	0.0021	0.0019	0.0018	0.0018	0.0017
Number of Sites	39	43	43	43	44	44	44	44	44	44	44	44

Figure 1.8 Malaysia: Annual Average Concentration of Sulphur Dioxide (SO_2), 1999-2010



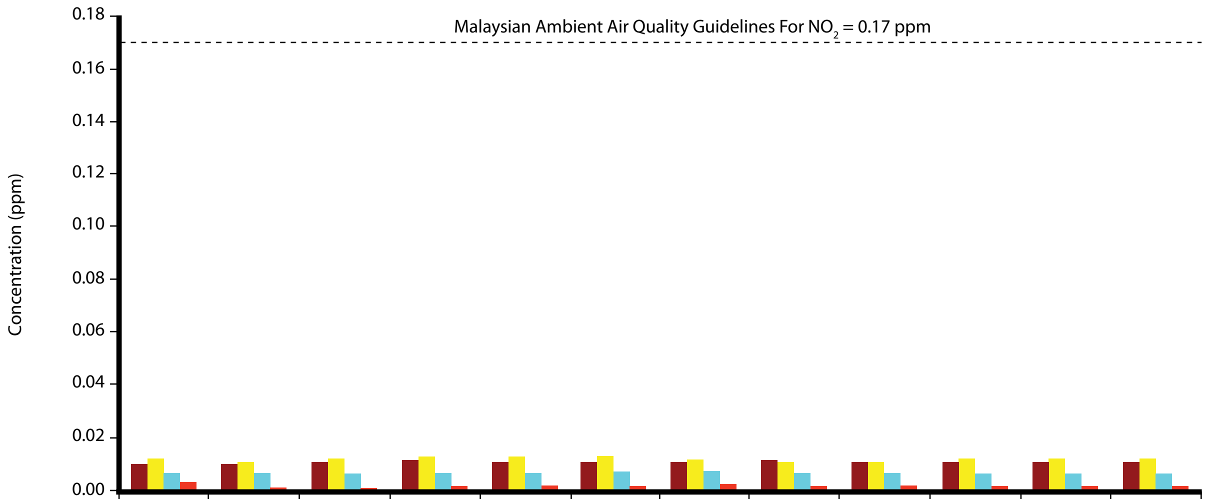
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Industrial	0.0073	0.0064	0.0057	0.0058	0.0050	0.0042	0.0034	0.0027	0.0025	0.0025	0.0023	0.0022
Urban	0.0039	0.0037	0.0030	0.0027	0.0026	0.0029	0.0025	0.0023	0.0019	0.0022	0.0020	0.0019
Sub Urban	0.0036	0.0038	0.0024	0.0020	0.0018	0.0015	0.0016	0.0014	0.0013	0.0013	0.0013	0.0012
Background	0.0022	0.0013	0.0009	0.0009	0.0010	0.0006	0.0009	0.0010	0.0005	0.0004	0.0009	0.0014

Figure 1.8(a) Malaysia: Annual Average Concentration of Sulphur Dioxide (SO_2) by Land Use, 1999-2010



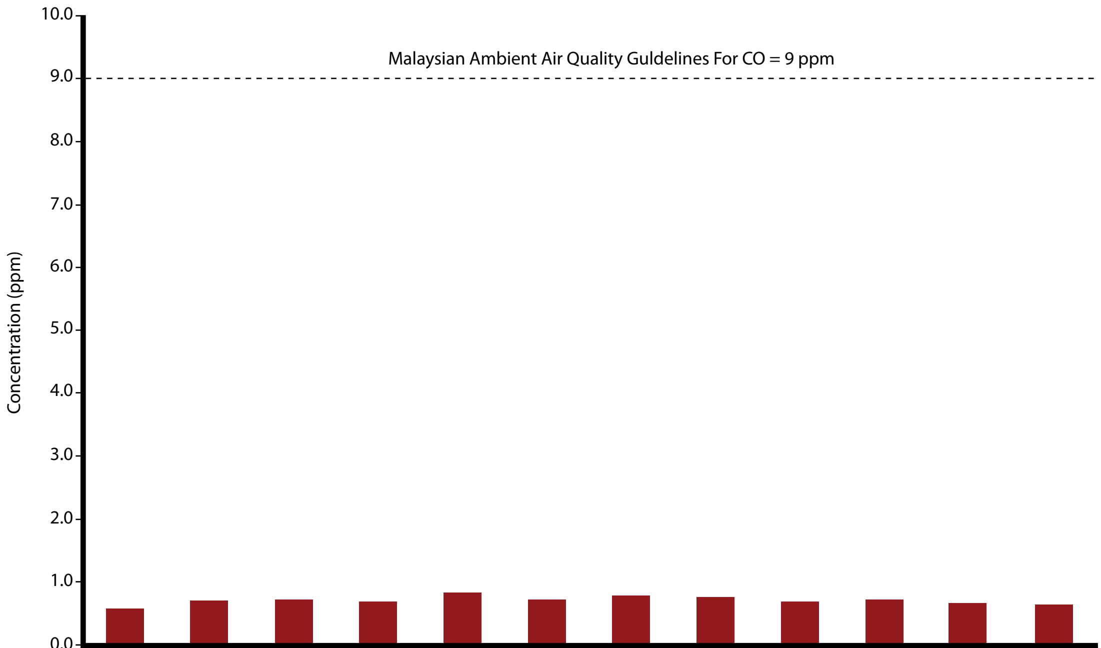
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Concentration	0.0074	0.0068	0.0073	0.0078	0.0078	0.0079	0.0095	0.0091	0.089	0.0094	0.0073	0.0089
Number of Sites	33	39	43	43	43	44	44	44	44	44	44	44

Figure 1.9 Malaysia: Annual Average of Nitrogen Dioxide (NO_2), 1999-2010



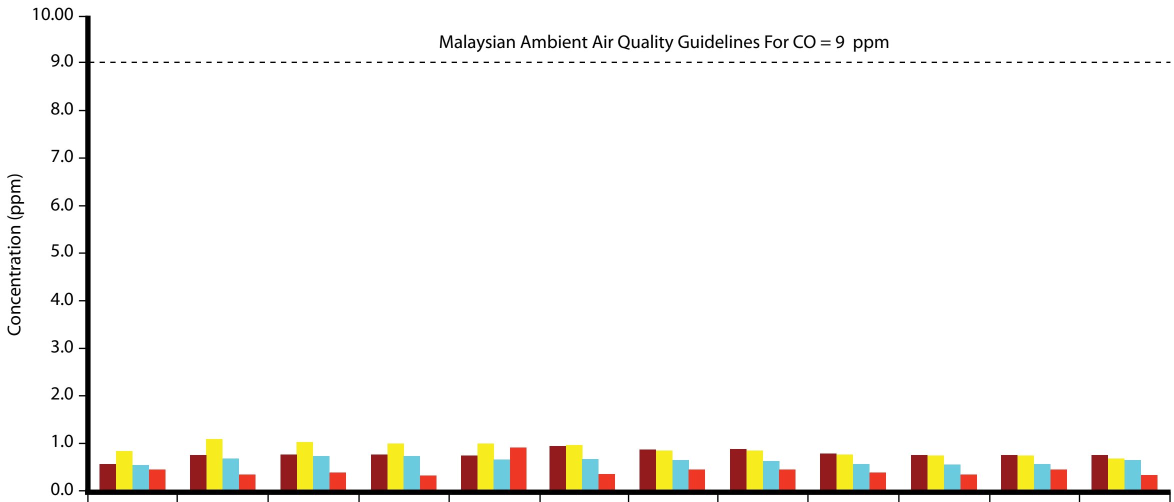
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Industrial	0.0096	0.0093	0.0105	0.0106	0.0104	0.0105	0.0105	0.0105	0.0103	0.0105	0.0100	0.0105
Urban	0.0112	0.0104	0.0113	0.0122	0.0123	0.0122	0.0106	0.0105	0.0104	0.0115	0.0110	0.0098
Sub Urban	0.0062	0.0062	0.0062	0.0065	0.0066	0.0068	0.0069	0.0066	0.0065	0.0066	0.0063	0.0073
Background	0.0030	0.0014	0.0013	0.0018	0.0017	0.0020	0.0026	0.0020	0.0022	0.0020	0.0020	0.0019

Figure 1.9(a) Malaysia: Annual Average Concentration of Nitrogen Dioxide (NO_2) by Land Use, 1999-2010



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Concentration	0.5860	0.7120	0.7213	0.6995	0.8325	0.7389	0.7918	0.7649	0.6973	0.7309	0.6752	0.6510
Number of Sites	35	39	39	39	41	44	41	41	41	41	41	41

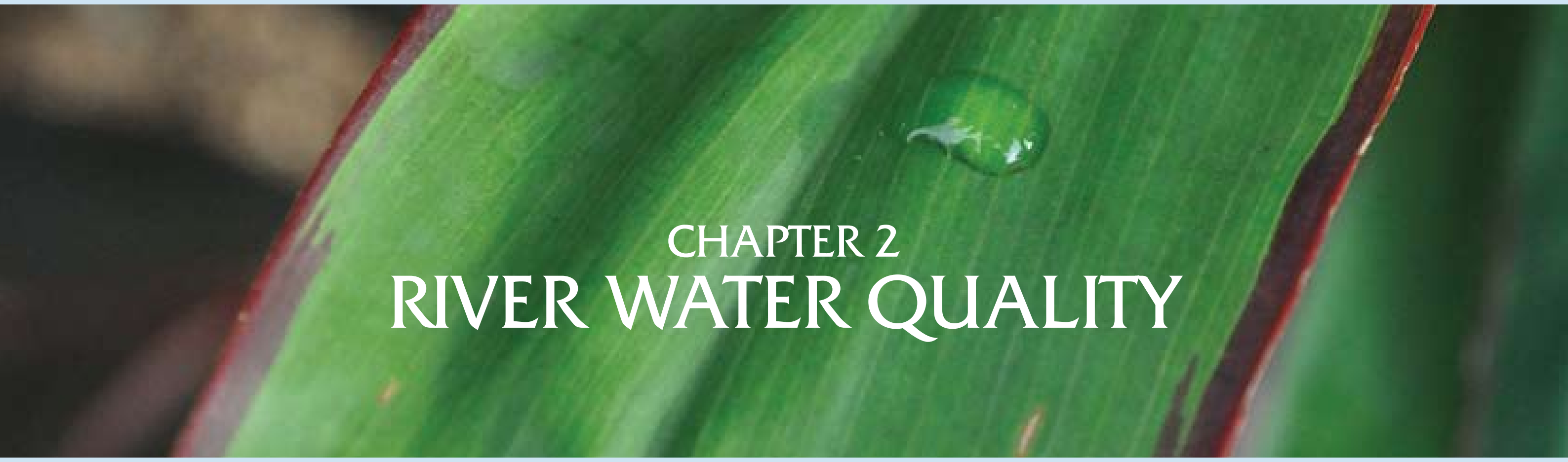
Figure 1.10 Malaysia: Annual Average Concentration of Carbon Monoxide (CO), 1999-2010



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Industrial	0.5550	0.7390	0.7614	0.7676	0.7405	0.9442	0.8734	0.8830	0.7977	0.7537	0.7501	0.7439
Urban	0.8220	1.0710	1.0091	0.9934	0.9981	0.9632	0.8636	0.8529	0.7635	0.7511	0.7288	0.6933
Sub Urban	0.5200	0.6890	0.7169	0.7187	0.6768	0.6784	0.6335	0.6150	0.5766	0.5509	0.5775	0.6541
Background	0.4480	0.3470	0.3978	0.3182	0.9145	0.3700	0.4582	0.4500	0.3924	0.3579	0.4379	0.3357

Figure 1.10(a) Malaysia : Annual Average Concentration of Carbon Monoxide (CO) by Land Use, 1999-2010

Clean air starts with a tree



CHAPTER 2
RIVER WATER QUALITY

River Water Quality

RIVER WATER QUALITY MONITORING

The Department of Environment (DOE) continued with the river water quality monitoring programme in 2010 to detect changes in river water quality. 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 2010, a total of 1,055 water quality monitoring stations located at 570 rivers were monitored. Out of these 1,055 monitoring stations, 527 (50%) were found to be clean, 417 (40%) slightly polluted and 111 (10%) polluted (**Tables 2.1, 2.2 and 2.3**). The number of clean rivers decreased from 306 rivers in 2009 to 293, slightly polluted rivers decreased from 217 in 2009 to 203 while the number of polluted rivers increased to 74 from 54 (2009). The trend of the river water quality is shown in **Figure 2.1**. The decrease in the number of clean rivers were attributed to an increase in the number of polluting sources such as sewage treatment plants and agro-based industries 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 2010, 15 incidences of distinctive pollution influx were observed as shown in **Table 2.4**.

Cumulative water quality data compiled from these 15 continuous water quality monitoring stations are presented in **Figures 2.2, 2.3, 2.4 and 2.5**. Based on the 90-percentile value, low dissolved oxygen levels were most frequent in Sungai Jinjang (19.0% saturation) followed by Sungai Perai (49.0% saturation) and Sungai Putat (54.5% saturation) (**Figure 2.2**). High ammonium levels were recorded more frequently in Sungai Jinjang (15.0 mg/l) followed by Sungai Putat (9.2 mg/l) and Sungai Perai (7.0 mg/l) (**Figure 2.3**). High turbidity level was most frequently detected at Sungai Melaka (800 NTU), followed by Sungai Rajang (630 NTU) and Sungai Batang Benar (500 NTU) (**Figure 2.4**). Meanwhile pH value of 6.4 was recorded at Sungai Selangor, pH 6.5 at Sungai Terengganu and pH 6.7 at Sungai Rajang (**Figure 2.5**).

RIVER WATER POLLUTION SOURCES

Figures 2.6, 2.7 and 2.8 show the status of river water quality in terms of BOD, NH_3-N and SS. Based on BOD level, 211 rivers were categorized as polluted, 255 rivers as slightly polluted and 104 rivers as clean (**Figure 2.6)**. Based on NH_3-N, 218 rivers were categorized as polluted, 205 rivers as slightly polluted and 147 rivers as clean **(Figure 2.7)**. Meanwhile, 156 rivers were categorized as polluted by SS, 80 rivers as slightly polluted and 334 rivers as clean **(Figure 2.8)**.

Water samples were also analysed for heavy metals. From the 4,565 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 94 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 had 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), Sungai Merbok (Kedah) and Sungai Kinabatangan (Sabah)

In the year 2010, the detailed study for Sungai Kuantan dan Sungai Sarawak were completed.

The waterfalls of Malaysia are some of the most pristine and largest in Southeast Asia

Table 2.1 Malaysia: Water Quality Status of Clean Rivers, 2010

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
PERLIS	PERLIS	JARUM	1	83	81	II	C
		JERNIH	2	81	88	II	C
		PELARIT	1	90	92	II	C
		WANG KELIAN	1	92	93	I	C
KEDAH	MERBOK	BUKIT MERAH	1	90	88	II	C
		TOK PAWANG	2	92	91	II	C
		TUPAH	2	95	84	II	C
	KISAP	KISAP	1	93	92	II	C
	ULU MELAKA	PETANG	1	92	93	I	C
		ULU MELAKA	1	86	82	II	C
	KEDAH	JANING	1	94	94	I	C
		PDG TERAP	4	86	81	II	C
		PEDU	1	90	86	II	C
		TEKAI	1	88	85	II	C
KEDAH/ P.PINANG	MUDA	CHEPIR	1	88	90	II	C
		KARANGAN	1	88	84	II	C
		KETIL	2	87	91	II	C
		MUDA	4	87	89	II	C
		PEGANG	1	93	87	II	C
		SEDIM	1	86	88	II	C
		TAWAR	1	90	95	I	C
P.PINANG	PINANG	AIR TERJUN	1	94	94	I	C
	KLUANG	KLUANG	1	65	86	II	C
	PERAI	KULIM	4	87	81	II	C
	JAWI	JUNJONG	3	69	94	I	C
P.PINANG/ PERAK	KERIAN	KECHIL	2	83	88	II	C
		KERIAN	4	81	82	II	C
		SERDANG	1	71	81	II	C
PERAK	RAJA HITAM	DERHAKA	2	66	82	II	C
		NYIOR	1	93	94	I	C
	KURAU	ARA	2	94	93	I	C
	SEPETANG	BATU TEGOH	3	87	88	II	C
		JANA	2	87	94	I	C
		LIMAU	1	87	93	I	C
		TEMERLOH	2	91	90	II	C
		TRONG	1	92	93	I	C
		TUPAI	1	84	87	II	C
	BRUAS	BRUAS	3	87	84	II	C
		DANDANG	1	86	90	II	C
		ROTAN	2	93	91	II	C
	PERAK	BATANG PADANG	3	85	81	II	C
		BIDOR	3	83	84	II	C
		CHENDERIANG	2	79	91	II	C
		CHEPOR	1	96	92	II	C
		CUAR	1	92	88	II	C
		KAMPAR	2	87	87	II	C

Table 2.1 Malaysia: Water Quality Status of Clean Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
		KANGSAR	2	87	84	II	C
		KINJANG	1	90	94	I	C
		KLAH	2	79	91	II	C
		KUANG	1	84	85	II	C
		PELUS	2	88	83	II	C
		PERAK	8	89	87	II	C
		RAIA	2	87	87	II	C
		SUNGKAI	2	84	82	II	C
PERAK/ SELANGOR	BERNAM	BERNAM	7	78	86	II	C
		INKI	1	93	93	I	C
		SLIM	3	90	86	II	C
		TROLAK	2	93	90	II	C
SELANGOR	LANGAT	BERANANG	1	78	84	II	C
		BUAN	1	76	81	II	C
		CHUAU	2	91	89	II	C
		JIJAN	1	77	85	II	C
		LIMAU MANIS	1	71	94	I	C
		LUI	1	91	94	I	C
	SELANGOR	BATANG KALI	1	91	92	II	C
		KANCHING	1	93	92	II	C
		KERLING	1	94	91	II	C
		SELANGOR	5	83	82	II	C
		SERENDAH	1	86	88	II	C
SELANGOR/WPKL	KLANG	SEMELAH	1	86	84	II	C
N.SEMBILAN	LINGGI	BATANG PENAR	3	82	92	II	C
		CHEMBONG	1	81	82	II	C
		KUNDUR BESAR	1	84	87	II	C
		PEDAS	1	79	81	II	C
		REMBAU	2	88	86	II	C
		SIPUT	2	84	83	II	C
MELAKA	MELAKA	DURIAN TUNGGAL	1	83	82	II	C
		KEMUNTING	1	88	84	II	C
		KERU	1	88	84	II	C
		TAMPIN	3	87	95	I	C
	DUYONG	GAPAM	1	92	86	II	C
JOHOR/ N.SEMBILAN	MUAR	AIR PANAS	1	94	93	I	C
		GEMENCHEH	2	79	81	II	C
		JUASSEH	2	89	90	II	C
		MEDA	1	83	83	II	C
JOHOR	BATU PAHAT	BANTANG	1	96	94	I	C
		CHAAH	1	91	90	II	C
		LENIK	1	87	86	II	C
		MEREK	1	88	81	II	C
	BENUT	PARIT HJ. YASSIN	1	80	85	II	C
	ENDAU	ANK SG. SEMBERONG	1	83	84	II	C

Table 2.1 Malaysia: Water Quality Status of Clean Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
		ENDAU	3	90	89	II	C
		JASIN	1	96	93	I	C
		KAHANG	1	87	84	II	C
		LENGGOR	1	84	83	II	C
		PALOH	1	86	85	II	C
		SELAI	1	94	92	II	C
		SEMBERONG	5	83	81	II	C
		TAMOK	1	92	91	II	C
	JOHOR	BELITONG	1	89	83	II	C
		BUKIT BESAR	2	87	86	II	C
		JOHOR	4	85	83	II	C
		LAYANG	1	92	90	II	C
		LAYAU KIRI	1	87	88	II	C
		LINGGIU	1	90	84	II	C
		PANTI	1	83	83	II	C
		PAPAN	1	89	82	II	C
		PELEPAH	2	93	94	I	C
		PENGGELI	2	91	86	II	C
		REMIS	1	86	84	II	C
		SAYONG	4	88	83	II	C
		SEMANGAR	1	88	87	II	C
		SENING	1	91	85	II	C
		TELOR	1	92	87	II	C
		TEMOH	1	91	90	II	C
	SEDILI BESAR	AMBAT	1	87	84	II	C
		DOHOL	1	86	81	II	C
		TEMUBOR KANAN	1	89	84	II	C
	PALOI	PALOI	1	86	82	II	C
	MERSING	MERSING	2	87	84	II	C
PAHANG	ANAK ENDAU	ANAK ENDAU	2	84	85	II	C
	ROMPIN	AUR	1	89	89	II	C
		JEKATIH	2	85	84	II	C
		JERAM	1	92	96	I	C
		KEPASING	1	89	92	II	C
		PONTIAN	1	90	86	II	C
		PUKIN	3	87	90	II	C
		ROMPIN	4	84	82	II	C
	MERCHONG	MERCHONG	2	84	87	II	C
	PAHANG	BATU	1	68	85	II	C
		BELAYAR	1	92	92	II	C
		BENTONG	4	90	88	II	C
		BENUS	2	93	91	II	C
		BERKAPOR	1	91	90	II	C
		BERTAM	3	82	87	II	C
		BILUT	1	87	90	II	C

Table 2.1 Malaysia: Water Quality Status of Clean Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
		BURUNG	1	96	91	II	C
		HABU	1	92	87	II	C
		JELAI	2	88	84	II	C
		JEMPOL	2	91	89	II	C
		KELAU	2	90	93	I	C
		KERTAM	1	88	90	II	C
		KOYAN	1	89	85	II	C
		LENGGOK	1	88	94	I	C
		LEPAR	3	88	88	II	C
		LIPIS	3	90	90	II	C
		LUIT	1	90	90	II	C
		MARAN	1	89	84	II	C
		PAHANG	8	87	87	II	C
		PENJURING	1	94	95	I	C
		PERTANG	2	83	87	II	C
		PERTING	1	92	93	I	C
		RINGLET	1	82	84	II	C
		SEMANTAN	3	85	85	II	C
		T. PAYA BUNGOR	1	91	86	II	C
		TAHAN	1	88	94	I	C
		TANGLIR	1	92	89	II	C
		TASIK BERA	1	84	82	II	C
		TASIK CHINI	10	90	85	II	C
		TEKAL	1	83	83	II	C
		TEKAM	2	86	87	II	C
		TELANG	1	88	81	II	C
		TELEMONG	1	94	95	I	C
		TELOM	2	91	85	II	C
		TEMBELING	1	91	94	I	C
		TERANUM	1	93	92	II	C
		TERAS	1	91	90	II	C
		TERLA	1	95	90	II	C
		TRIANG	2	87	84	II	C
		TRINGKAP	1	85	86	II	C
	KUANTAN	BELAT	1	84	84	II	C
		CHARU	1	88	90	II	C
		KENAU	1	93	92	II	C
		KUANTAN	5	89	89	II	C
		PANDAN	1	88	92	II	C
		REMAN	1	73	89	II	C
	BEBAR	MERBA	1	81	85	II	C
TERENGGANU	CHUKAI	IBOK	2	87	82	II	C
	KEMAMAN	CHERUL	2	89	86	II	C
		KEMAMAN	3	88	88	II	C
		PERASING	1	87	84	II	C

Table 2.1 Malaysia: Water Quality Status of Clean Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
	KERTIH	KERTIH	2	86	86	II	C
	PAKA	PAKA	2	81	84	II	C
	DUNGUN	DUNGUN	4	87	91	II	C
		TELEMBOH	1	84	89	II	C
	MARANG	TEMALA	1	88	93	I	C
	TERENGGANU	BERANG	2	94	91	II	C
		NERUS	4	66	86	II	C
		PUEH	2	91	84	II	C
		TELEMONG	1	87	89	II	C
		TERENGGANU	3	85	85	II	C
	SETIU	CHALOK	2	87	81	II	C
		SETIU	2	91	92	II	C
	BESUT	BESUT	3	90	89	II	C
		JERTIH	1	73	87	II	C
	KLUANG	KLUANG	1	85	86	II	C
KELANTAN	KEMASIN	SEMERAK	3	83	88	II	C
	KELANTAN	ARING	1	90	93	I	C
		BELATOP	2	82	82	II	C
		BER	1	93	89	II	C
		BEROK	3	89	85	II	C
		BETIS	1	94	91	II	C
		CHIKU	1	83	93	I	C
		GALAS	5	90	89	II	C
		KELANTAN	3	85	85	II	C
		KERILLA	2	95	92	II	C
		LEBIR	4	88	89	II	C
		NAL	3	89	91	II	C
		NENGGIRI	3	90	86	II	C
		PEHI	1	88	90	II	C
		PERGAU	6	93	92	II	C
		RELAI	2	92	86	II	C
		SOKOR	1	86	85	II	C
		TUANG	1	94	92	II	C
	GOLOK	GOLOK	5	91	88	II	C
		LANAS	1	89	93	I	C
SARAWAK	SARAWAK	SARAWAK KIRI	1	79	81	II	C
		SEMADANG	1	96	89	II	C
	SIMILAJAU	SIMILAJAU	2	86	81	II	C
	LIMBANG	LIMBANG	5	87	85	II	C
	TRUSAN	TRUSAN	1	87	88	II	C
	LAWAS	LAWAS	3	86	88	II	C
	LUPAR	AI	2	91	90	II	C
		SEKERANG	1	89	91	II	C
		SETERAP	1	82	81	II	C
		UNDUP	1	82	85	II	C

Table 2.1 Malaysia: Water Quality Status of Clean Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
	RAJANG	BINATANG	1	88	85	II	C
		JULAU	1	86	85	II	C
		KANOWIT	1	86	85	II	C
	NIAH	NIAH	2	80	84	II	C
	SARIBAS	LAYAR	2	79	82	II	C
	SIBUTI	KEJAPIL	1	83	81	II	C
	MIRI	PADANG LIKU	1	87	89	II	C
SABAH	MENGGALONG	MENGGALONG	2	89	85	II	C
	LAKUTAN	LAKUTAN	1	90	89	II	C
	LINGKUNGAN	BUKAU	1	88	87	II	C
		LINGKUNGAN	1	91	91	II	C
	PADAS	BUNSIT	1	96	90	II	C
		LIAWAN	1	96	91	II	C
		PADAS	3	77	81	II	C
		PANGATAN	1	88	81	II	C
		PEGALAN	3	89	83	II	C
		TANDULU	1	96	91	II	C
	MEMBAKUT	MEMBAKUT	1	83	88	II	C
	KIMANIS	KIMANIS	1	86	84	II	C
	BONGAWAN	BONGAWAN	1	85	84	II	C
	PAPAR	PAPAR	3	90	88	II	C
	MOYOG	MOYOG	4	91	91	II	C
	TUARAN	DAMIT	2	90	88	II	C
		SONG SAI	1	92	90	II	C
		TUARAN	2	92	89	II	C
	KEDAMAIAN	KEDAMAIAN	1	95	94	I	C
		TEMPASUK	2	92	94	I	C
		WARIU	1	94	94	I	C
	TENGHILAN	TENGHILAN	1	91	91	II	C
	BINGKONGAN	BANDAU	1	94	92	II	C
		BINGKONGAN	2	93	92	II	C
		MENGGARIS	2	92	92	II	C
		TANDEK	1	88	86	II	C
	BENGKOKA	BENGKOKA	2	89	85	II	C
	PAITAN	PAITAN	1	88	83	II	C
	SUGUT	BONGKUD	1	96	94	I	C
		LOHAN	1	94	91	II	C
		MERALI	1	95	94	I	C
		SUGUT	3	92	92	II	C
	LABOK	KINIPIR	2	91	92	II	C
		LABOK	1	90	90	II	C
		LIWAGU	2	88	91	II	C
		MALIAU	1	95	92	II	C
		TUNGUD	1	89	87	II	C
	SAPI	SAPI	3	82	81	II	C

Table 2.1 Malaysia: Water Quality Status of Clean Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
		SUALONG	1	92	85	II	C
	MOUNAD	MOUNAD	2	86	82	II	C
	TUNGKU	TUNGKU	2	85	89	II	C
	SILABUKAN	SILABUKAN	2	85	84	II	C
	TAWAU	TAWAU	4	86	82	II	C
	APAS	APAS	1	89	90	II	C
	BALUNG	BALUNG	1	86	88	II	C
	MEROTAI	MEROTAI	3	87	85	II	C
	BRANTIAN	BRANTIAN	1	86	85	II	C
	TELIPOK	TELIPOK	2	82	82	II	C
	SEGAMA	SEGAMA	3	80	86	II	C
	UMAS-UMAS	UMAS-UMAS	1	77	81	II	C
	KALABAKAN	KALABAKAN	3	75	81	II	C
	LIKAS	INANAM	3	83	84	II	C
		MENGGATAL	2	87	91	II	C
	SEGALIUD	SEGALIUD	2	78	82	II	C
	KINABATANGAN	KARAMUAK	1	92	90	II	C
		KINABATANGAN	4	78	83	II	C
		KOYAH	1	84	82	II	C
		LEEPANG	1	76	90	II	C
		MENANGGUL	1	72	81	II	C
	KALUMPANG	KALUMPANG	3	85	87	II	C

A stroll along Kuching Waterfront, Sarawak

Table 2.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2010

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
PERLIS	PERLIS	KOK MAK	1	70	77	II	SP
		NGULANG	1	75	74	III	SP
		PERLIS	1	72	69	III	SP
KEDAH	KUAH	KUAH	1	73	70	III	SP
	MERBOK	BAKAR ARANG	1	68	61	III	SP
		BONGKOK	1	75	64	III	SP
		MERBOK	1	76	69	III	SP
	KEDAH	KEDAH	1	65	63	III	SP
		PENDANG	1	80	76	III	SP
KEDAH/ P.PINANG	MUDA	JERUNG	2	74	66	III	SP
P.PINANG	JURU	KILANG UBI	5	70	65	III	SP
		PMTG RAWA	1	69	62	III	SP
	KLUANG	ARA	2	84	80	II	SP
		RELAU	1	73	65	III	SP
	PERAI	JARAK	5	74	67	III	SP
		KELADI	1	80	76	III	SP
	BAYAN LEPAS	BAYAN LEPAS	1	69	60	III	SP
		TIRAM	2	69	74	III	SP
	JAWI	MACHANG BUBOK	1	76	79	II	SP
P.PINANG/ PERAK	KERIAN	SELAMA	2	74	72	III	SP
PERAK	RAJA HITAM	MANJONG	2	85	80	II	SP
		RAJA HITAM	3	73	61	III	SP
	KURAU	KURAU	4	80	79	II	SP
	SEPETANG	LARUT	1	79	73	III	SP
		MALAI	1	60	61	III	SP
		SEPETANG	2	77	71	III	SP
	WANGI	WANGI	2	70	69	III	SP
	PERAK	KEPAYANG	2	73	72	III	SP
		KINTA	8	76	78	II	SP
		NYAMOK	1	73	61	III	SP
		PARI	2	70	72	III	SP
		PINJI	2	70	65	III	SP
		SELUANG	1	52	64	III	SP
		SEROKAI	2	71	70	III	SP
		SUNGKAI MATI	2	61	75	III	SP
		TUMBOH	1	72	71	III	SP
SELANGOR/WPKL	KLANG	AMPANG	1	69	61	III	SP
		BATU	3	71	74	III	SP
		DAMANSARA	3	59	66	III	SP
		GOMBAK	3	82	80	II	SP
		KLANG	10	60	61	III	SP
		KUYOH	1	63	65	III	SP
SELANGOR	LANGAT	ANAK CHUAU	1	75	78	II	SP
		BALAK	1	62	60	III	SP
		BATANG BENAR	2	69	75	III	SP
		BATANG LABU	2	72	76	III	SP

Table 2.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
		LANGAT	8	71	72	III	SP
		PAJAM	1	72	75	III	SP
		SEMENYIH	3	77	75	III	SP
	SEPANG	SEPANG	3	75	75	III	SP
	TENGI	TENGI	3	77	72	III	SP
	SELANGOR	AIR HITAM	1	68	73	III	SP
		KUNDANG	1	57	76	III	SP
		RAWANG	1	72	80	II	SP
		SEMBAH	1	68	74	III	SP
N.SEMBILAN	LINGGI	KAYU ARA	1	68	75	III	SP
		KEPAYONG	1	78	78	II	SP
		LINGGI	6	75	73	III	SP
		PAROI	1	78	77	II	SP
		SENAWANG	1	67	60	III	SP
		SIMIN	1	73	75	III	SP
		SIMPANG EMPAT	1	78	70	III	SP
MELAKA	DUYONG	DUYONG	3	78	70	III	SP
	TUANG	BARU	1	69	65	III	SP
	SERI MELAKA	SERI MELAKA	1	67	62	III	SP
	MELAKA	BTG.MELAKA	2	82	78	II	SP
		MELAKA	9	70	73	III	SP
		PUTAT	2	60	66	III	SP
		REMBIA	2	70	61	III	SP
	KESANG	CHOHONG	2	92	80	II	SP
		KESANG	3	86	71	III	SP
JOHOR/ N.SEMBILAN	MUAR	GEMAS	1	78	71	III	SP
		KELAMAH	1	55	63	III	SP
		LABIS	3	80	73	III	SP
		MERBUDU	1	74	78	II	SP
		MERLIMAU	1	66	62	III	SP
		MUAR	17	79	80	II	SP
		P. MENKUANG	1	83	80	II	SP
		PALONG	2	79	80	II	SP
		SARANG BUAYA	1	53	60	III	SP
		SEGAMAT	1	81	80	II	SP
		SPG. LOI	1	77	77	II	SP
		TENANG	1	68	61	III	SP
JOHOR	BATU PAHAT	AMRAN	1	68	71	III	SP
		BEKOK	5	80	77	II	SP
		BERLIAN	1	69	74	III	SP
		MERPO	1	74	77	II	SP
		SEMBERONG	2	64	63	III	SP
		SIMPANG KIRI	3	66	63	III	SP
	BENUT	BENUT	4	76	72	III	SP
		ULU BENUT	1	83	74	III	SP

Table 2.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
	PONTIAN BESAR	AIR HITAM	1	71	68	III	SP
		PONTIAN BESAR	5	67	63	III	SP
	PONTIAN KECIL	PONTIAN KECIL	2	75	73	III	SP
	SKUDAI	MELANA	2	64	71	III	SP
		SKUDAI	9	64	68	III	SP
	PULAI	PULAI	2	79	80	II	SP
		ULU CHOH	1	67	76	III	SP
	KIM-KIM	KIM-KIM	2	75	73	III	SP
	JEMALUANG	JEMALUANG	2	80	80	II	SP
	ENDAU	DENGAR	1	63	72	III	SP
		JEBONG	1	72	65	III	SP
		LENGA	1	56	68	III	SP
		MAMAI	1	86	79	II	SP
		MELATAI	1	61	60	III	SP
		MENGKIBOL	3	71	69	III	SP
		PAMOL	1	70	65	III	SP
		SINGOL	1	84	77	II	SP
	TEBRAU	TEBRAU	5	69	66	III	SP
	KAW. PASIR GUDANG	MASAI	1	57	60	III	SP
	JOHOR	ANAK SG. SAYONG	2	83	74	III	SP
		BERANGAN	1	63	67	III	SP
		CHEMANGAR	1	82	78	II	SP
		LEBAM	1	75	71	III	SP
		SANTI	1	83	77	II	SP
		SEBOL	1	78	79	II	SP
		SELUYUT	1	82	78	II	SP
		SEMENCHU	1	74	67	III	SP
		TIRAM	4	74	79	II	SP
	SEDILI BESAR	PASIR PANJANG	1	76	64	III	SP
		SEDILI BESAR	5	83	79	II	SP
	SEDILI KECIL	ANAK SEDILI KECIL	1	81	75	III	SP
		BAHAN	2	85	74	III	SP
		SEDILI KECIL	3	84	79	II	SP
PAHANG	ROMPIN	BAKAR	1	72	78	II	SP
		KERATONG	3	82	79	II	SP
	PAHANG	BERA	3	83	78	II	SP
		CHINI	1	82	79	II	SP
		JENGKA	2	83	80	II	SP
		KUNDANG	1	76	76	III	SP
		MENTIGA	2	86	80	II	SP
		SERTING	5	75	68	III	SP
	KUANTAN	PINANG	1	80	80	II	SP
		RIAU	1	74	76	III	SP
		TALAM	1	72	69	III	SP
	BEBAR	BEBAR	2	75	69	III	SP
		SERAI	2	72	71	III	SP

Table 2.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
	BALOK	BALOK	2	76	67	III	SP
		PANJANG	1	74	74	III	SP
		YIOR	1	65	61	III	SP
	CHERATING	CHERATING	1	80	78	II	SP
	TONGGOK	TONGGOK	2	77	68	III	SP
TERENGGANU	CHUKAI	BUNGKUS	1	77	73	III	SP
		CHUKAI	1	86	70	III	SP
		RUANG	2	70	64	III	SP
	IBAI	IBAI	3	75	76	III	SP
	MERCHANG	LANDAS	1	67	78	II	SP
		MERCHANG	1	73	74	III	SP
	MERANG	MERANG	1	69	75	III	SP
	KEMAMAN	NERAM	1	77	78	II	SP
	PAKA	BESUL	1	90	72	III	SP
		RASAU	2	84	77	II	SP
		RENGAT	1	80	71	III	SP
	MARANG	KERAK	1	85	78	II	SP
		MARANG	1	88	78	II	SP
	SETIU	TAROM	1	82	79	II	SP
KELANTAN	KEMASIN	KEMASIN	2	80	74	III	SP
	GOLOK	TASIK GARU	1	78	79	II	SP
	PENGKALAN DATU	PENGKALAN DATU	3	83	80	II	SP
	PENGKALAN CHEPA	ALOR B	1	65	62	III	SP
		KELADI	1	76	79	II	SP
		PENGKALAN CHEPA	2	78	74	III	SP
		RAJA GALI	1	78	76	III	SP
SARAWAK	KAYAN	KAYAN	3	76	72	III	SP
	SEMUNSAM	SEMUNSAM	1	80	75	III	SP
	BALINGIAN	BALINGIAN	2	80	75	III	SP
	NIAH	SEKALOH	2	70	76	III	SP
	SADONG	KARANGAN	2	61	75	III	SP
		SADONG	4	71	76	III	SP
	SARIBAS	SARIBAS	1	73	69	III	SP
	KERIAN	KERIAN	2	71	77	II	SP
		SEBLAK	1	77	78	II	SP
	MUKAH	MUKAH	4	75	73	III	SP
	KEMENA	KEMENA	4	77	80	II	SP
		SIBIU	1	73	76	III	SP
	SUAI	SUAI	1	78	71	III	SP
	SIBUTI	KABULOH	2	64	61	III	SP
		SATAP	1	79	61	III	SP
		SIBUTI	2	79	77	II	SP
	MIRI	LUTONG	2	70	63	III	SP
	BARAM	BARAM	4	77	77	II	SP
		TUTUH	1	80	73	III	SP

Table 2.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
	SARAWAK	KUAP	2	82	73	III	SP
		MAONG KIRI	1	71	67	III	SP
		SAMARAHAN	2	75	76	III	SP
		SARAWAK	6	85	80	II	SP
		SARAWAK KANAN	1	86	77	II	SP
		SEMENGGOH	1	78	70	III	SP
		TABUAN	1	81	68	III	SP
	LUPAR	LUPAR	3	73	77	II	SP
	RAJANG	BALOI	1	81	80	II	SP
		MERADONG	1	80	71	III	SP
		RAJANG	11	79	74	III	SP
		SALIM	1	80	73	III	SP
		SARIKEI	2	80	78	II	SP
	OYA	OYA	3	83	78	II	SP
	TATAU	TATAU	1	83	80	II	SP
SABAH	TINGKAYU	TINGKAYU	2	83	80	II	SP
	SEMBULAN	SEMBULAN	2	68	72	III	SP
	LIKAS	DARAU	1	75	67	III	SP
		LIKAS	2	65	76	III	SP
	KINABATANGAN	PIN	1	78	73	III	SP
		TAKALA	1	77	77	II	SP

Beautiful river of Malaysia

Table 2.3 Malaysia : Water Quality Status of Polluted Rivers, 2010

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
PERLIS	PERLIS	SERAI	1	75	53	III	P
KEDAH	MERBOK	KOROK	1	45	53	III	P
		PETANI	1	58	56	III	P
P.PINANG	JAWI	CHEMPEDAK	1	44	40	IV	P
		JAWI	1	52	52	III	P
		TENGAH	1	36	25	V	P
	PINANG	AIR ITAM	5	64	53	III	P
		DONDANG	3	51	43	IV	P
		JELUTONG	1	39	34	IV	P
		PINANG	1	64	52	III	P
	JURU	ARA	1	49	27	V	P
		JURU	2	60	52	III	P
		PASIR	1	63	51	IV	P
		RAMBAI	2	53	44	IV	P
	PERAI	AIR MELINTAS	1	50	40	IV	P
		KEREH	2	57	49	IV	P
		KUBANG SEMANG	1	63	48	IV	P
		PERAI	2	65	59	III	P
		PERTAMA	1	61	55	III	P
		SELUANG	1	56	53	III	P
		SELUANG BAWAH	2	60	51	IV	P
PERAK	SEPETANG	LIDIN	1	58	58	III	P
	WANGI	DERALIK	2	62	55	III	P
	PERAK	KERDAH	2	70	56	III	P
		SINTANG	1	70	53	III	P
SELANGOR	LANGAT	BATANG NILAI	2	53	57	III	P
		RINCHING	1	60	56	III	P
	SEPANG	RAMBAI	1	54	33	IV	P
	BULOH	BULOH	5	58	50	IV	P
SELANGOR/WPKL	KLANG	BUNOS	1	47	38	IV	P
		JINJANG	2	58	58	III	P
		KERAYONG	2	48	46	IV	P
		KEROH	2	50	56	III	P
		PENCHALA	1	42	49	IV	P
N.SEMBILAN	LUKUT	LUKUT	1	72	59	III	P
	LINGGI	TEMIANG	2	68	52	III	P
MELAKA	SERI MELAKA	AIR SALAK	1	58	53	III	P
	KESANG	CHIN-CHIN	1	54	51	IV	P
		TANGKAK	1	63	57	III	P
	MERLIMAU	MERLIMAU	4	54	58	III	P
JOHOR/ N.SEMBILAN	MUAR	SENARUT	1	66	53	III	P
		SEROM	1	70	56	III	P
JOHOR	BATU PAHAT	BATU PAHAT	1	60	54	III	P
		SIMPANG KANAN	2	58	56	III	P
	RAMBAH	RAMBAH	2	63	57	III	P

Table 2.3 Malaysia : Water Quality Status of Polluted Rivers, 2010 (continued)

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2010)	
				2009	2010	CLASS	CATEGORY
	BENUT	PINGGAN	1	65	57	III	P
	PONTIAN BESAR	AYER MERAH	1	35	36	IV	P
	SANGLANG	SANGLANG	1	61	54	III	P
	JOHOR	SERAI	1	57	50	IV	P
	SEDILI BESAR	MUPUR	1	75	59	III	P
	AIR BALOI	AIR BALOI	3	48	46	IV	P
	SEGGET	SEGGET	5	50	51	IV	P
	TEBRAU	BALA	1	56	51	IV	P
		PANDAN	1	51	54	III	P
		PLENTONG	1	42	50	IV	P
		SEBULUNG	1	44	56	III	P
		SENGKUANG	1	31	39	IV	P
		TAMPOI	1	41	51	IV	P
	DANGA	DANGA	2	52	49	IV	P
	KAW. PASIR GUDANG	BULUH	1	36	39	IV	P
		LATOH	1	57	58	III	P
		PEREMBI	1	46	42	IV	P
		TUKANG BATU	1	36	33	IV	P
	KEMPAS	KEMPAS	2	57	57	III	P
PAHANG	PAHANG	ANAK SG. LEPAR	1	68	59	III	P
	KUANTAN	GALING BESAR	1	60	47	IV	P
		GALING KECIL	1	69	58	III	P
TERENGGANU	KEMAMAN	RANSAN	2	58	52	III	P
KELANTAN	PENGKALAN CHEPA	ALOR LINTAH	1	55	45	IV	P
SARAWAK	MIRI	ADONG	1	56	51	IV	P
		DALAM	1	60	53	III	P
		MIRI	2	65	59	III	P
SABAH	KALUMPANG	PANG BURONG 1	1	49	50	IV	P
		PANG BURONG 2	1	63	52	III	P

Table 2.4 Malaysia : Pollution Influx Observed at Continuous Water Quality Station

Station	Date	Parameter	Pollution Sources
Melaka	8-Jan-10	pH: 7.16	Sewage or latex based industry
Batang Benar	11-Jan-10	NH_4: 4.85 mg/l	Sewage or latex based industry or industrial discharge
Batang Benar	21-Jan-10	pH: 8.71	Sewage or latex based industry or industrial discharge
Melaka	22-Jan-10	pH: 7.77	Sewage or latex based industry
Putat	27-Jan-10	pH: 8.23	Sewage or latex based industry or industrial discharge
Putat	28-Jan-10	pH: 8.34	Sewage or latex based industry or industrial discharge
Batang Benar	5-Feb-10	pH: 8.94	Sewage or latex based industry or industrial discharge
Batang Benar	18-Feb-10	NH_4: 6.18 mg/l	Sewage or latex based industry or industrial discharge
Labu	26-Feb-10	NH_4: 7.09 mg/l	Sewage or latex based industry or industrial discharge
Labu	5-Mar-10	NH_4: 5.64 mg/l	Sewage or latex based industry or industrial discharge
Batang Benar	13-Mar-10	pH: 10.16	Sewage or latex based industry or industrial discharge
Labu	21-Apr-10	NH_4: 4.21 mg/l	Sewage or latex based industry or industrial discharge
Melaka	14-May-10	pH: 8.77	Sewage or latex based industry
Batang Benar	28-May-09	pH: 9.17	Sewage or latex based industry or industrial discharge
Putat	26-Jun-10	pH: 8.59	Sewage or latex based industry or industrial discharge
Labu	8-Dec-10	NH_4: 2.90 mg/l	Sewage or latex based industry

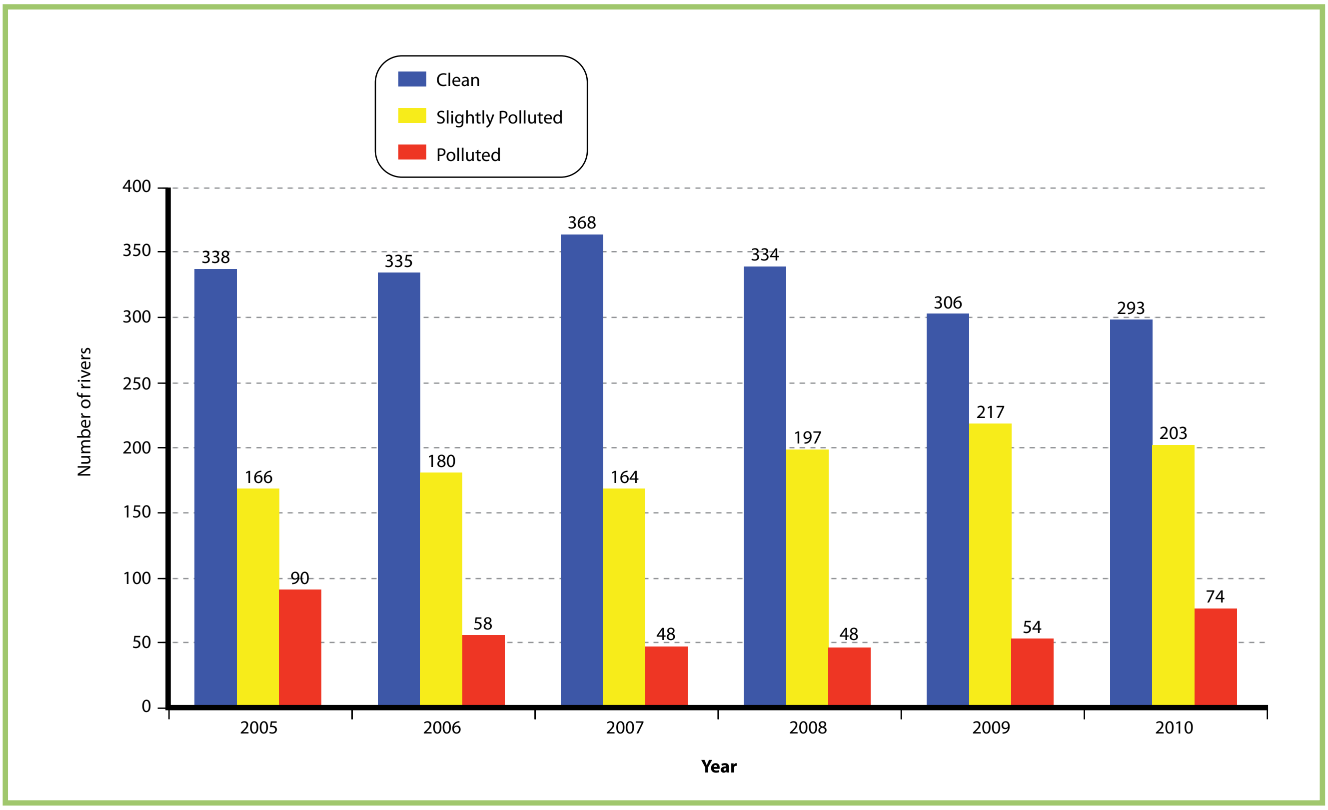


Figure 2.1 Malaysia: River Water Quality Trend (2005-2010)

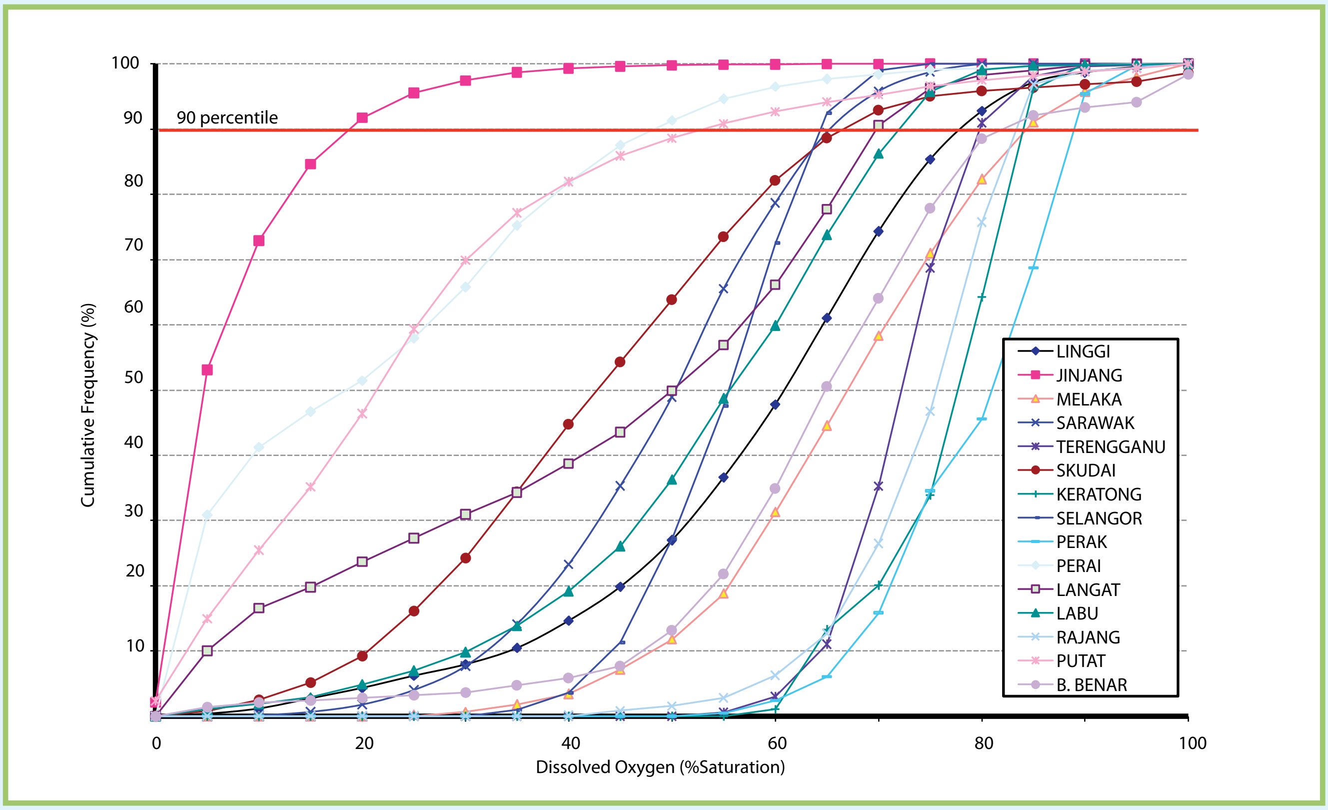


Figure 2.2: Comparison of Cumulative Frequency for 15 CWQM Stations - Dissolved Oxygen: 1st January - 31st December 2010

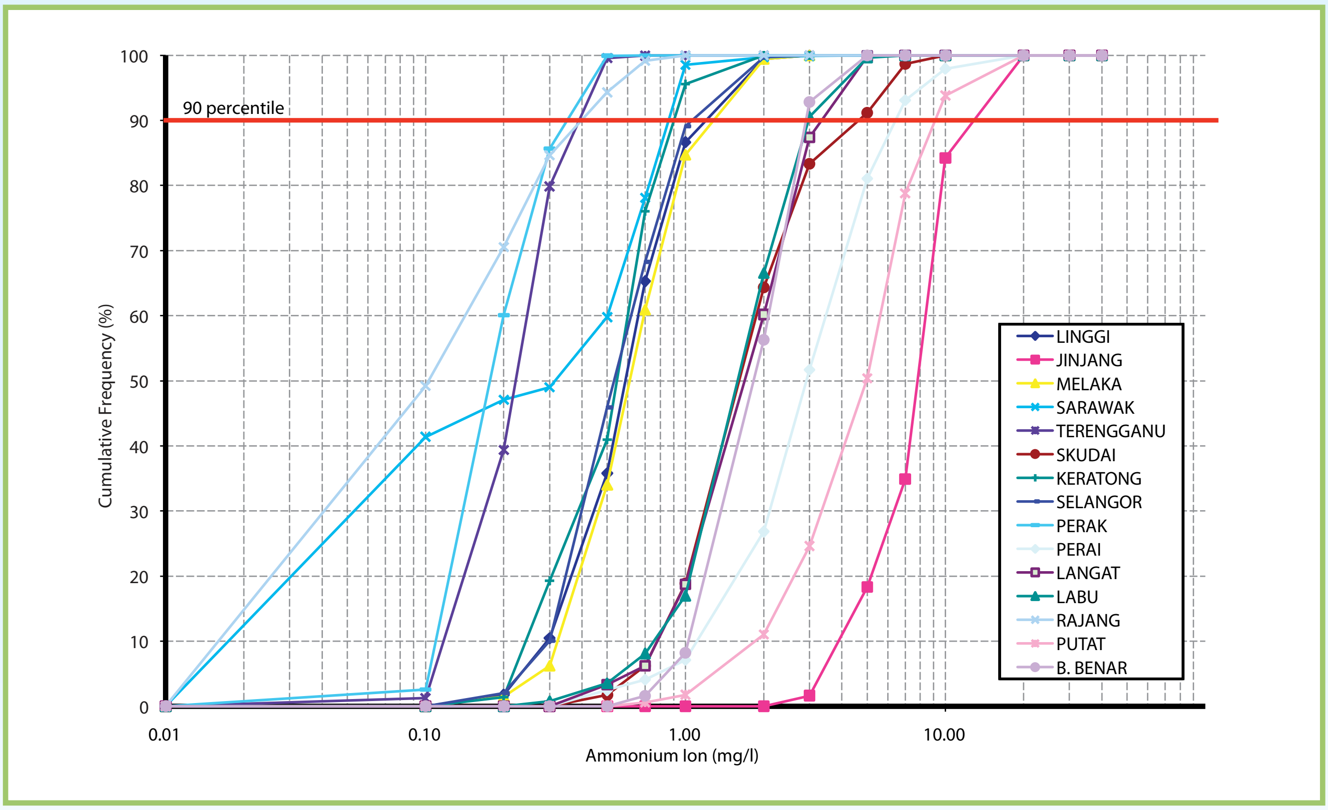


Figure 2.3: Comparison of Cumulative Frequency for 15 CWQM Stations - Ammonium Ion Concentration: 1st January - 31st December 2010

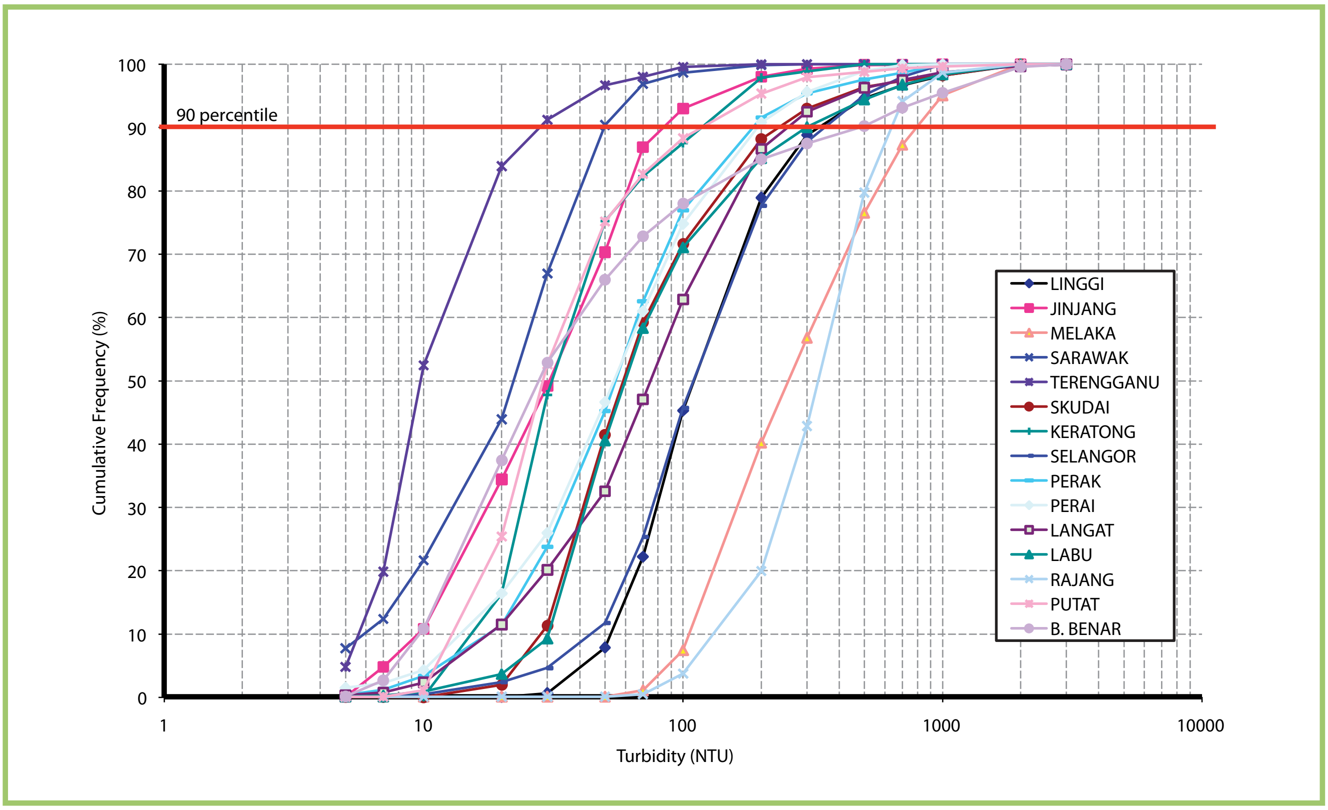


Figure 2.4: Comparison of Cumulative Frequency for 15 CWQM Stations - Turbidity: 1st January - 31st December 2010

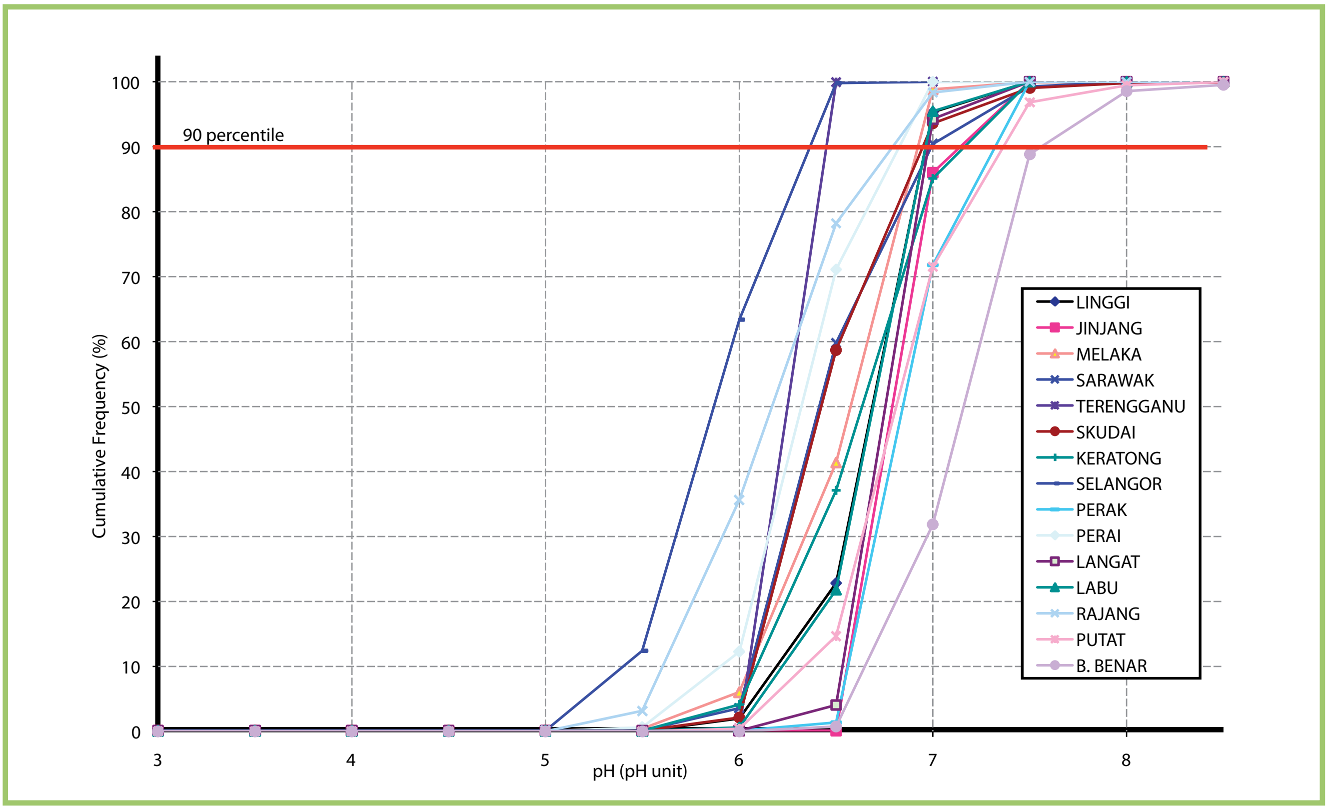


Figure 2.5: Comparison of Cumulative Frequency for 15 CWQM Stations - pH Level: 1st January - 31st December 2010

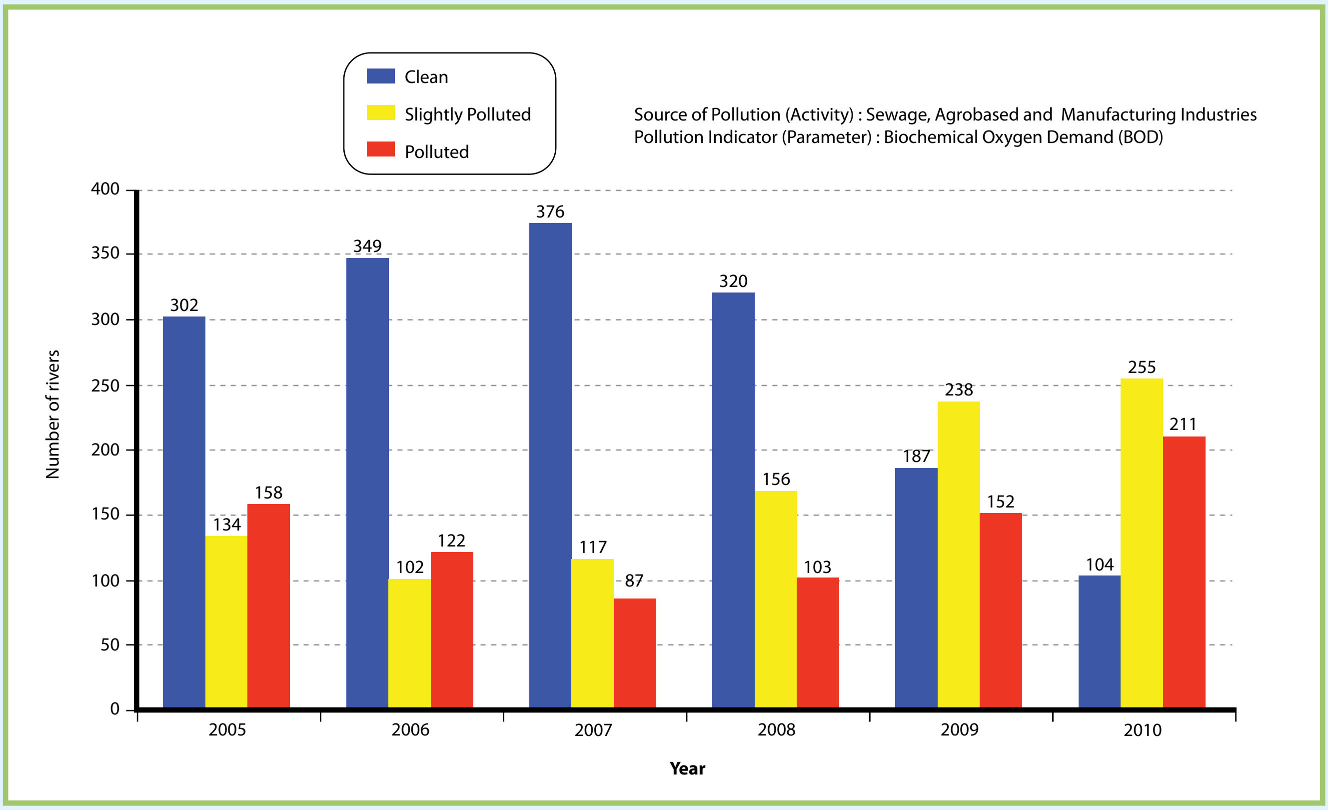


Figure 2.6: River Water Quality Trend based on BOD sub-index (2005-2010)

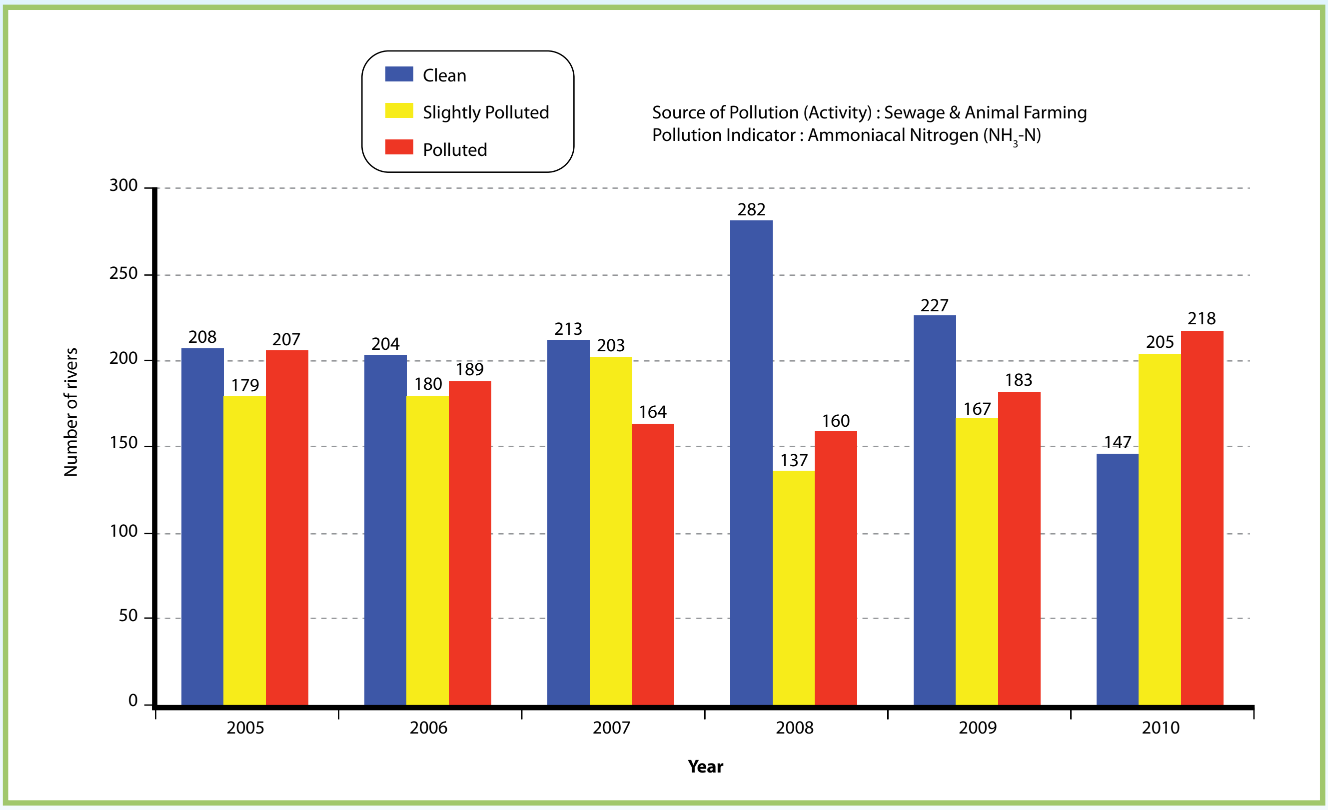


Figure 2.7: River Water Quality Trend based on AN sub-index (2005-2010)

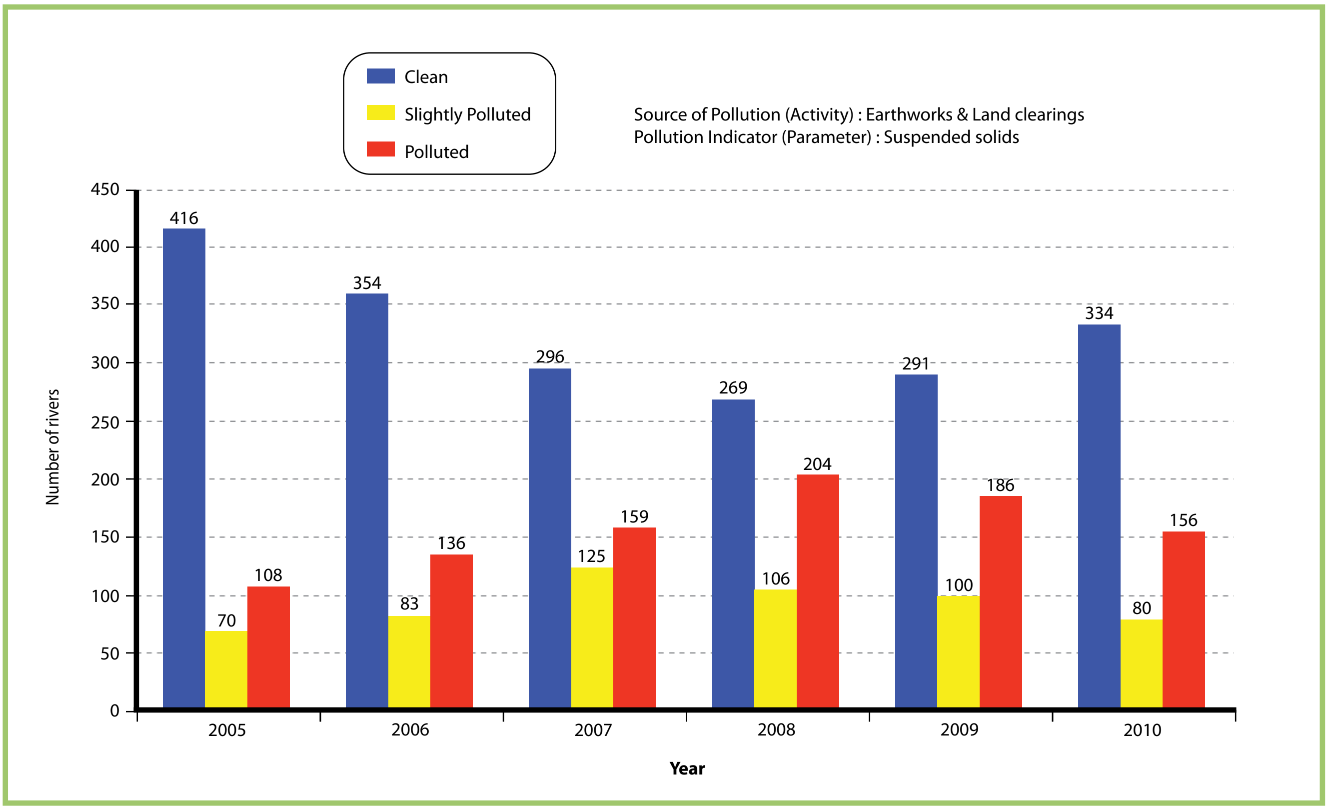
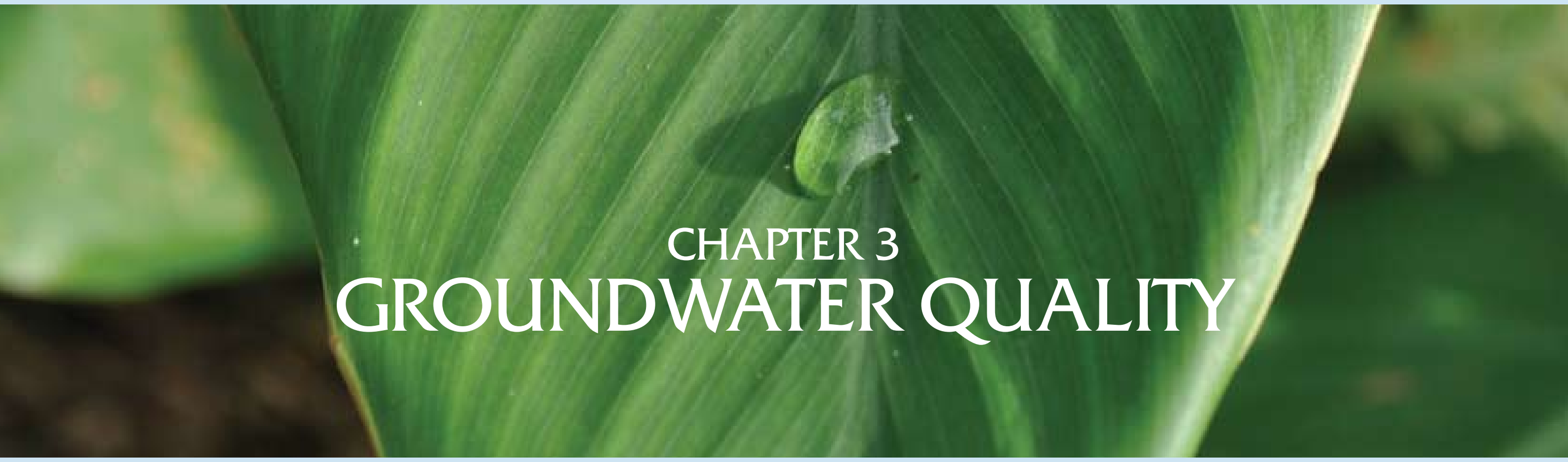


Figure 2.8: River Water Quality Trend based on SS sub-index (2005-2010)



CHAPTER 3
GROUNDWATER QUALITY

Groundwater Quality

GROUNDWATER QUALITY MONITORING

Groundwater quality monitoring was carried out using 81 monitoring wells in Peninsular Malaysia, 16 wells in Sarawak and 15 wells in Sabah (**Table 3.1**) 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, animal burial areas, municipal water supply and ex-mining (gold mine).

GROUNDWATER QUALITY STATUS

In 2010, 201 water samples were taken from these monitoring wells and analysed for volatile organic compounds (VOCs), pesticides, heavy metals, anions, bacteria (coliform), phenolic compounds, total hardness, total dissolved solids (TDS), pH, temperature, conductivity and dissolved oxygen (DO). The results were then compared with the National Guidelines For Raw Drinking Water Quality established by the Ministry of Health (Revised December 2000) (**Table 3.2**) to determine the status of its quality.

Table 3.1 Malaysia : Distribution of Groundwater Monitoring Wells, 2010

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

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.

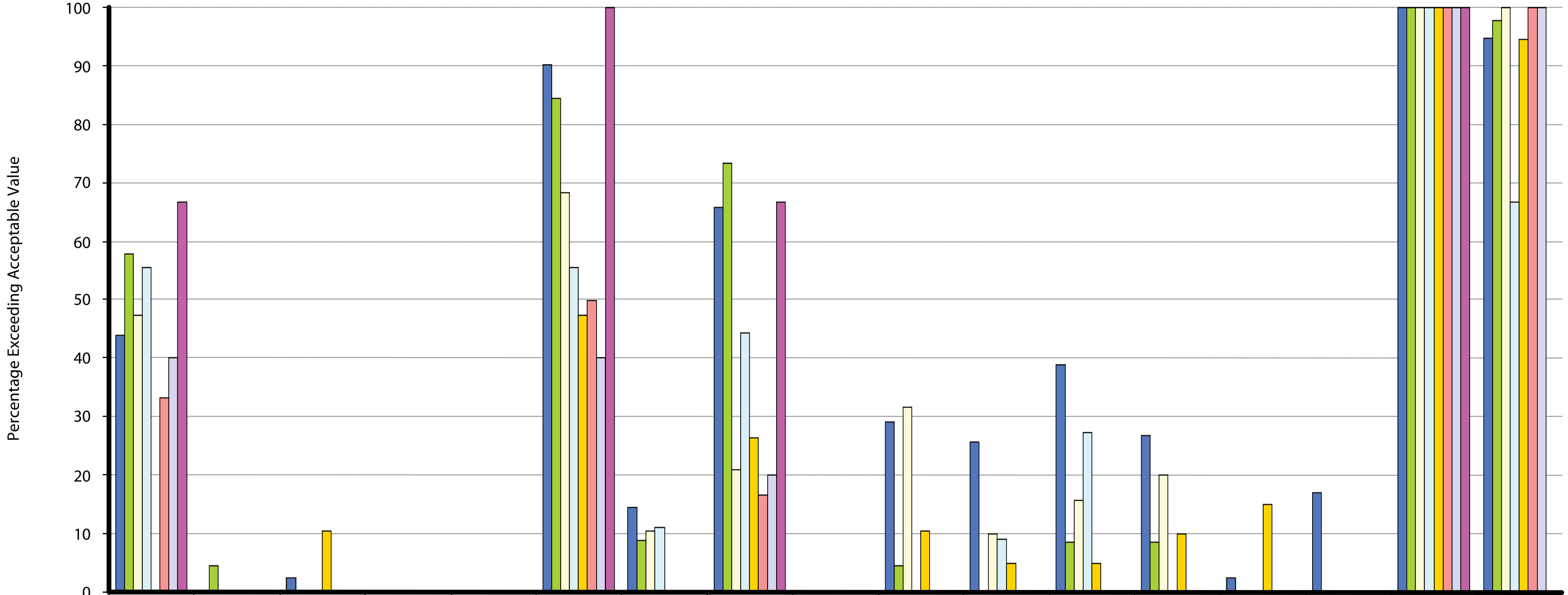
The least number of samples exceeding the guideline values were mercury (Hg), cadmium (Cd), nitrate (NO_3) and sulphate (SO_4). There has been no exceedance of chromium (Cr), copper (Cu) and zinc (Zn) recorded in all samples monitored. **Figure 3.1** shows the percentage of the samples exceeding the guideline values for all the parameters monitored.

Well maintained landfill can prevent groundwater contamination

Table 3.2 Malaysia: National Guidelines for Raw Drinking Water Quality (Revised December 2000)

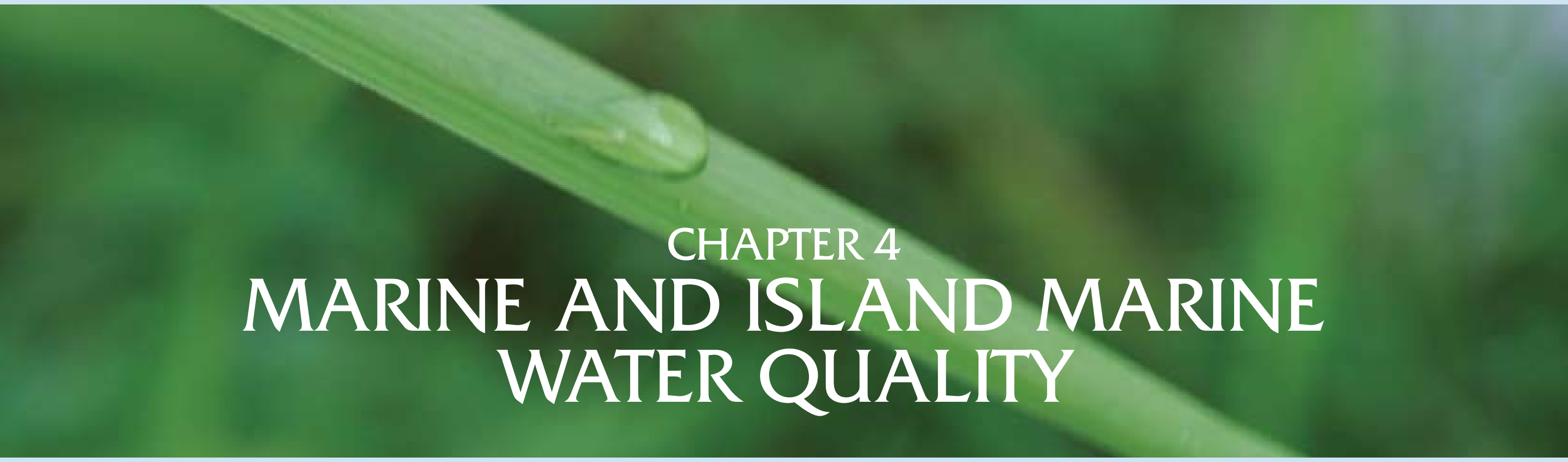
Parameter	Symbol	Benchmark
Sulphate	SO_4	250 mg/l
Hardness	$CaCO_3$	500 mg/l
Nitrate	NO_3	10 mg/l
Coliform	-	Must not be detected in any 100 ml sample
Manganese	Mn	0.1 mg/l
Chromium	Cr	0.05 mg/l
Zinc	Zn	3 mg/l
Arsenic	As	0.01 mg/l
Selenium	Se	0.01 mg/l
Chloride	Cl	250 mg/l
Phenolics	-	0.002 mg/l
TDS	-	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-Coliform	Phenol
Industrial	44	0	2	0	0	90	15	66	0	29	26	39	27	2	17	100	95
Landfills	58	4	0	0	0	84	9	73	0	4	0	9	9	0	0	100	98
Agriculture	47	0	0	0	0	68	11	21	0	32	10	16	20	0	0	100	100
Municipal Water Supply	56	0	0	0	0	56	11	44	0	0	9	27	0	0	0	100	67
Urban/Suburban	0	0	11	0	0	47	0	26	0	11	5	5	10	15	0	100	94
Golf Courses	33	0	0	0	0	50	0	17	0	0	0	0	0	0	0	100	100
Rural Areas	40	0	0	0	0	40	0	20	0	0	0	0	0	0	0	100	100
Ex-Mining	67	0	0	0	0	100	0	67	0	0	0	0	0	0	0	100	0

Figure 3.1 Malaysia: Percentage of Non-Compliance of Selected Contaminants by Land Use, 2010



CHAPTER 4
MARINE AND ISLAND MARINE WATER QUALITY

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 the 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 4.1**. The Malaysian Marine Water Quality Criteria and Standards (MWQCS) are as shown in **Table 4.2**.

Simply breathtaking!

Table 4.1 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

Table 4.2 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	Mangroves, 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	50 mg/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
13	Ammonia (unionized) (µg/L)	35	70	320	70
14	Nitrite (NO_2) (µg/L)	10	55	1000	55
15	Nitrate (NO_3) (µg/L)	10	60	1000	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/100 ml) *100 E.coli/100ml (70 E.coli/100ml)*	200 faecal coliform/100ml *200 E.coli/100ml*	100 faecal coliform/100ml (70 faecal coliform/100 ml) *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*

MARINE WATER QUALITY STATUS FOR COASTAL AREAS

In 2010 a total of 500 samples from 161 coastal monitoring stations were collected for analysis as shown in **Table 4.3**. The most number of samples that exceeded Class 2 of the Marine Water Quality Criteria and Standards (MWQCS) were oil and grease (45.2%), followed by total suspended solids (42.8%) and *Escherichia coli* (41.3%).

Oil and grease remained a significant contaminant of coastal waters with 100 percent of samples from Kedah and Selangor, followed by Kelantan (91%) and Terengganu (71%) exceeded the MWQCS. Melaka and Sarawak recorded levels the lowest percentage (<10%) exceeding the MWQCS while Pahang recorded no contamination of oil and grease (**Table 4.3**).

For total suspended solids contamination, Sarawak and Kelantan recorded the highest percentage (82%) exceeding the MWQCS, followed by Terengganu (81%), while Kedah and Labuan were free from total suspended solids contamination. *E. coli* contamination was recorded highest in Melaka (89%), followed by Selangor (85%) and Negeri Sembilan (72%).

Heavy metals pollution was comparatively high in coastal waters with copper (Cu) exceeding the MWQCS by 64.1 percent, followed by lead (44.4%) and chromium (40.3%), while cadmium, mercury and arsenic were relatively low at 30.5%, 18.5% and 0.6% respectively. Langkawi, Kedah, Pahang and Terengganu recorded the highest percentage of copper contamination (100%) exceeding the MWQCS.

Total suspended solids in the marine waters can be attributed to 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 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 well as from land-based sources. As for heavy metals they can be from natural sources, coastal development activities and land-based discharges.

MARINE WATER QUALITY STATUS FOR ESTUARIES

A total of 263 samples from 76 estuary monitoring stations were collected for analysis in 2010 **(Table 4.4)**. The most number of samples exceeding the MWQCS (Class E) were *Escherichia coli* (61.5%), followed by oil and grease (53.4%) and total suspended solids (23.0%).

Escherichia coli remained a significant contaminant of estuary waters with Pulau Pinang recorded the highest percentage (87%) exceeding the MWQCS followed by Perak (83%) and Selangor (79%). Kedah recorded no contamination of *Escherichia coli* (**Table 4.4**).

For oil and grease contamination, Selangor recorded the highest percentage (93%) exceeding the MWQCS, followed by Kelantan (91%) and Negeri Sembilan (88%), while Melaka recorded levels less than 10 percent. Total suspended solids contamination was recorded highest in Perak (75%), followed by Selangor (41%) and Kelantan and Melaka (36%).

Heavy metals pollution was comparatively high with copper (Cu) exceeding the MWQCS by 62.7 percent, followed by lead (46.6%) and cadmium (35.2%). Copper contamination was evident in Perlis and Melaka (100%). Meanwhile, chromium was recorded at 32.9 percent, mercury at 23.6 percent and arsenic at 0.3 percent.

Table 4.3 Malaysia: Status of Marine Water Quality Parameters Exceeding Standards for Coastal (%), 2010

			Parameter Exceeding Standard (%)								
State	No. of Station	No. of Sample	Total Suspended Solids	Oil and Grease	*Escherichia coli*	Arsenic	Cadmium	Chromium	Cuprum	Plumbum	Mercury
Perlis	-	-	-	-	-	-	-	-	-	-	-
Pulau Langkawi	7	28	15	55	24	0	100	100	100	100	35
Kedah	1	2	0	100	50	0	100	100	100	100	50
Pulau Pinang	18	106	60	22	64	0	8	2	30	2	45
Perak	7	14	54	14	14	0	0	93	93	79	0
Selangor	4	13	62	100	85	8	0	0	38	23	31
N. Sembilan	11	44	28	88	72	0	0	30	51	60	49
Melaka	7	37	66	9	89	0	0	33	90	33	0
Johor	39	106	35	27	24	1	0	0	73	29	7
Pahang	11	11	29	0	33	0	0	0	100	0	0
Terengganu	7	21	81	71	25	0	100	81	100	95	5
Kelantan	5	10	82	91	17	0	91	80	91	83	0
W.P. Labuan	5	20	0	25	5	0	0	40	0	0	0
Sabah	24	58	6	23	25	0	25	4	2	7	16
Sarawak	15	30	82	7	52	0	4	0	28	10	21
Malaysia (Sum)	161	500	TSS	O & G	*E.coli*	As	Cd	Cr	Cu	Pb	Hg
Average (%)			42.8	45.2	41.3	0.6	30.5	40.3	64.1	44.4	18.5

Table 4.4 Malaysia: Status of Marine Water Quality Parameters Exceeding Standards for Estuary (%), 2010

			Parameter Exceeding Standard (%)								
State	No. of Station	No. of Sample	Total Suspended Solids	Oil and Grease	*Escherichia coli*	Arsenic	Cadmium	Chromium	Cuprum	Plumbum	Mercury
Perlis	2	22	20	60	56	0	80	100	100	80	70
Pulau Langkawi	-	-	-	-	-	-	-	-	-	-	-
Kedah	2	5	0	33	0	0	33	0	33	33	0
Pulau Pinang	7	54	15	50	87	0	17	9	6	0	69
Perak	6	11	75	67	83	0	33	50	83	67	0
Selangor	10	29	41	93	79	3	3	14	45	52	41
N. Sembilan	2	8	0	88	75	0	0	38	63	63	75
Melaka	5	28	36	8	74	0	0	33	100	33	0
Johor	12	33	0	39	50	0	0	0	87	44	0
Pahang	-	-	-	-	-	-	-	-	-	-	-
Terengganu	13	37	22	68	50	0	100	78	95	89	0
Kelantan	5	10	36	91	77	0	100	73	91	82	8
W.P. Labuan	-	-	-	-	-	-	-	-	-	-	-
Sabah	2	6	0	33	50	0	50	0	0	17	0
Sarawak	10	20	31	12	57	0	6	0	50	0	20
Malaysia (Sum)	76	263	TSS	O & G	*E.coli*	As	Cd	Cr	Cu	Pb	Hg
Average (%)			23.0	53.4	61.5	0.3	35.2	32.9	62.7	46.6	23.6

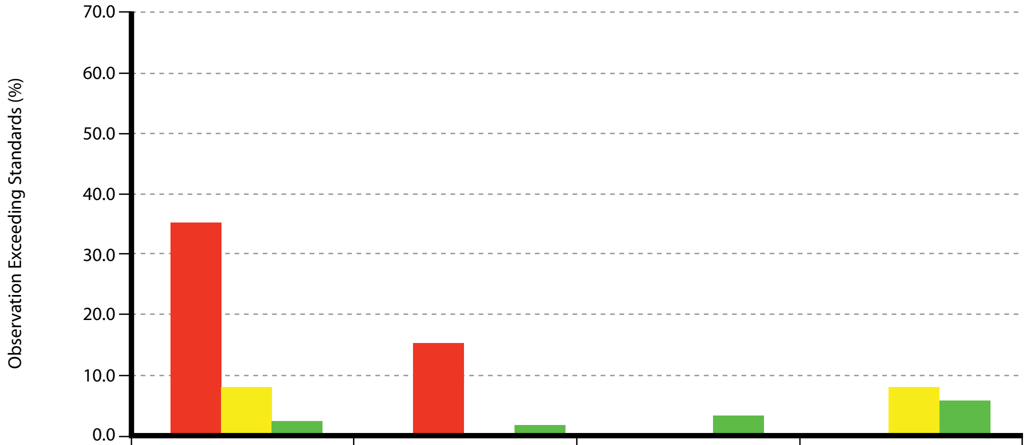
ISLAND MARINE WATER QUALITY STATUS

The waters around 73 islands monitored in 2010 were categorised as development islands (3 islands), resort islands (32 islands), marine park islands (22 islands) and protected islands (15 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 the Malaysian Marine Water Quality 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 development and resort islands. In development islands 35 percent exceeded the standards and followed by resort islands 15 percent. In terms of total suspended solids, protected islands and development islands recorded levels exceeding the standards by 8 percent while marine parks and resorts recorded no contamination. For oil and grease, all category islands samples exceeded the standards. Protected islands recorded the highest percentage (5.8%) exceeding the standards followed by marine park islands (3.0%), development islands (2.0%) and resort islands (1.6%) **(Figure 4.1).**

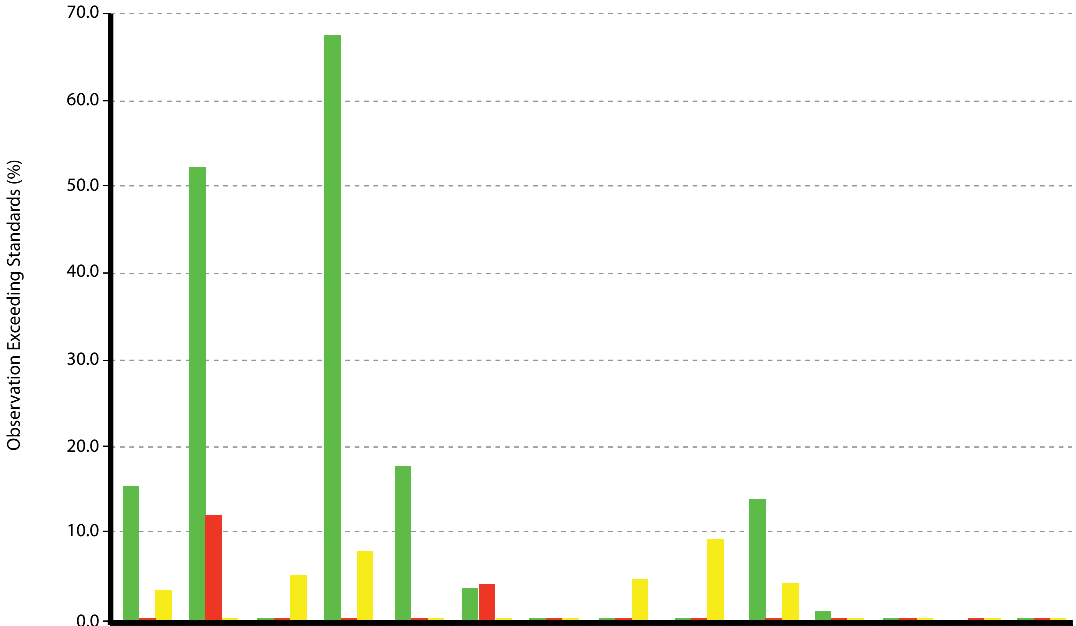
As shown in **Figure 4.2**, *E. coli* contamination was highest in Selangor island marine waters where 66.7 percent of the samples exceeded the standard of 100 MPN/100 ml followed by Pulau Pinang (52.3%) and Melaka (18.2%). As for total suspended solids, Pulau Pinang recorded the highest samples exceeding the standard at 11.9 percent and followed by Johor (3.7%). However, total suspended solids for islands in other states were in compliance. Oil and grease was detected in Sarawak with 9.1 percent of samples monitored exceeded the standards, followed by Selangor (8.3%), Perak (5.3%), Terengganu (4.8%), Labuan (3.8%) and Kedah (3.1%). Other states were free of oil and grease pollution.

Eco-friendly resort is the way to go



	Development	Resort	Marine Park	Protected
E - coli	35.0	15.0	0.0	0.0
Total Suspended Solids	8.0	0.0	0.0	8.0
Oil - Grease	2.0	1.6	3.0	5.8

Figure 4.1 Malaysia : Island Marine Water Quality Status, 2010



	Kedah	P. Pinang	Perak	Selangor	Melaka	Johor	Pahang	Terengganu	Sarawak	W.P.Labuan	Sabah	N.Sembilan	Kelantan	Perlis
E - coli	15.6	52.3	0.0	66.7	18.2	3.3	0.0	0.0	0.0	14.3	1.4	0.0	0.0	0.0
Total Suspended Solids	0.0	11.9	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil - Grease	3.1	0.0	5.3	8.3	0.0	0.0	0.0	4.8	9.1	3.8	0.0	0.0	0.0	0.0

Figure 4.2 Malaysia : Status of Island Marine Water Quality by State, 2010

TARBALL MONITORING

Tarball residues on beaches are usually caused by oily discharges from fishing boats as well as passing vessels. In 2010 it was found that all the 139 monitoring stations were free from tarball pollution.

ASSESSMENT 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 Malaysian Marine Water Quality and Standard (MWQCS) for TSS, Oil and Grease and *E.coli*. **Table 4.5** shows the 10 best coastal and estuarine water quality and **Table 4.6** shows the 10 best islands water quality.

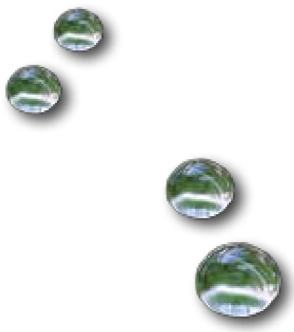


Table 4.5 Malaysia: 10 Best Coastal and Estuary Sites 2010

State	Sites	Category
Kedah	Pantai Tengah	Coastal
	Pantai Kok	Coastal
Negeri Sembilan	Teluk Pelanduk	Coastal
Sabah	Pantai Teluk Brunei 4	Coastal
	Pantai Bak-Bak Kudat	Coastal
	Pantai Ulu Tungku	Coastal
Sarawak	Pantai Damai	Coastal
	Kuala Sungai Semantan	Estuary
W.P. Labuan	Pantai Sungai Pagar	Coastal
Terengganu	Pantai Chendering	Coastal

Table 4.6 Malaysia: 10 Best Islands Monitoring Sites 2010

State	Sites	Category
Kedah	Singa Besar	Resort
	Teluk Ewa	Development
Perak	Pangkor (Pantai Puteri Dewi)	Resort
Sabah	Pulau Manukan	Marine Park
	Pulau Mabul	Resort
Terengganu	Pinang	Marine Park
	Bidong Laut	Resort
Pahang	Tioman (Kg. Nipah)	Marine Park
Sarawak	Pulau Talang-Talang Besar	Protected
Johor	Pulau Pemanggil	Marine Park

CHAPTER 5
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 2010, 20,348 water pollution point source were recorded. These comprise of manufacturing industries (9,069: 44.57%), sewage treatment plants (10,025: 49.27% inclusive of 790 Network Pump Stations), animal farms (754: 3.70%) and agro-based industries (500: 2.46%) as shown in **Figure 5.1**.

The DOE compiles statistics of industrial water pollution sources from agro-based and manufacturing industries through field surveys and questionnaires. **Figure 5.2** shows the distribution of these sources in 2010. A total of 9,569 sources were identified with Johor having the highest number of water pollution sources (4,620: 48.28%).

Data from the Veterinary Department of Malaysia shows that there was a decrease of 0.42 percent of standing pig pollution in 2010 (1,665,795) as compared to 2009 (1,672,893).

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 9,676 in 2009 to 10,025 in 2010. Selangor had the largest number of sewage treatment plants (2856:28.49%), followed by Perak (1508:15.04%), Johor (1123:11.20%) and Negeri Sembilan (974:9.72%) (**Figure 5.3**).

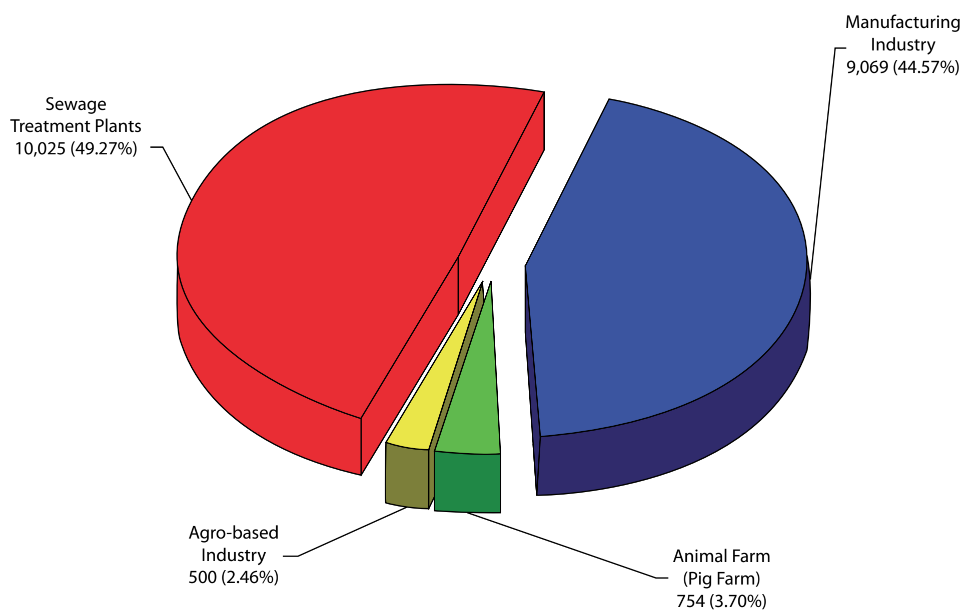


Figure 5.1 Malaysia: Composition of Water Pollution Sources by Sector, 2010

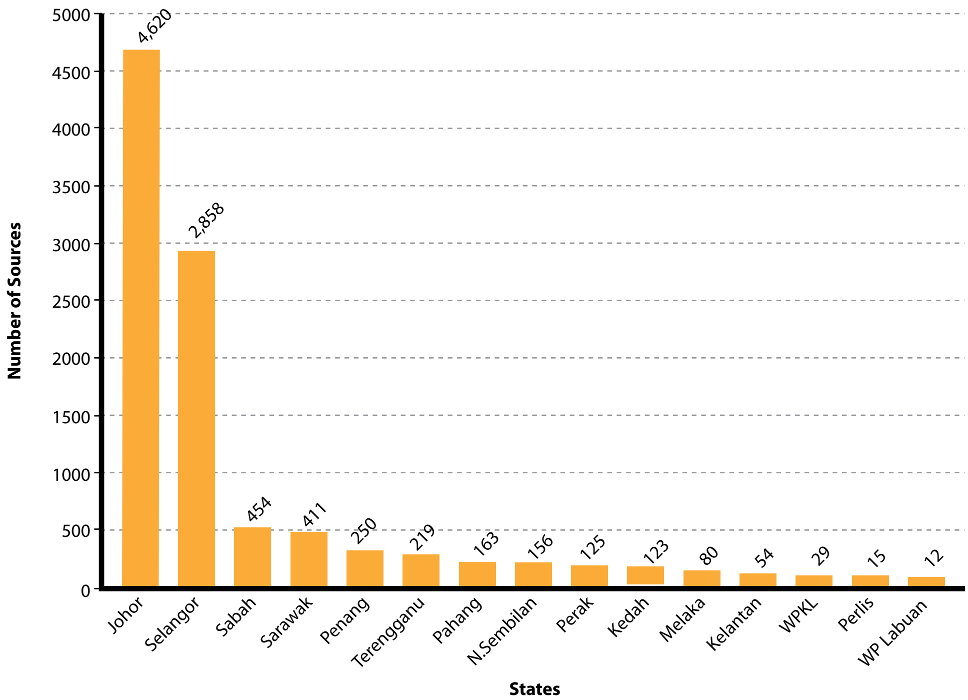


Figure 5.2 Malaysia: Distribution of Industrial Water Pollution Sources (Agro-based and Manufacturing Industries) by State, 2010

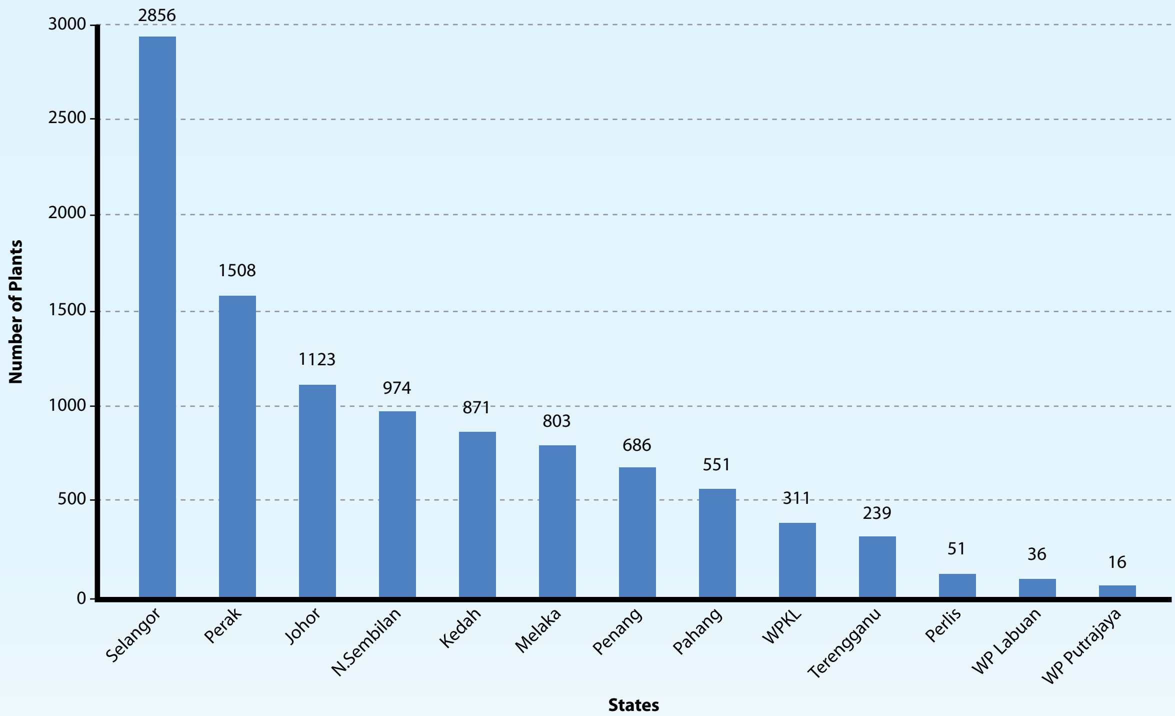


Figure 5.3 Malaysia: Distribution of Sewage Treament Plants by State, 2010

Table 5.1 Malaysia : Distribution of Sewage Treatment Plant by State, 2010

State	No. of STP	Total PE	Flow (m^3/d)	BOD Load (kg/day)
Selangor	2856	7,043,712	1,584,835	396,208.80
Perak	1508	1,433,688	322,580	80,644.95
Johor	1123	1,504,464	338,504	84,626.10
Negeri Sembilan	974	1,208,137	271,831	67,957.71
Kedah	871	705,655	158,772	39,693.09
Melaka	803	689,520	155,142	38,785.50
Penang	686	1,628,069	366,316	91,578.88
Pahang	551	367,682	82,728	20,682.11
WP Kuala Lumpur	311	3,401,586	765,357	191,339.21
Terengganu	239	76,641	17,244	4,311.06
Perlis	51	30,629	6,892	1,722.88
WP Labuan	36	42,863	9,644	2,411.04
WP Putrajaya	16	28,706	6,459	1,614.71
Total	**10,025**	**18,161,352**	**4,086,304.20**	**1,021,576.05**

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

BOD LOAD

In terms of BOD load, domestic treated and partially treated sewage remained the largest contributor with an estimated load of 1,021,576.05 kg/day. The other major contributors were pig farming (199,024.28 kg/day) and agro-based manufacturing industries (108, 439.32 kg/day).

Table 5.1 shows the total BOD load in kg/day discharged from sewage treatment plants in the states managed by IWK in 2010.

SOURCES OF AIR POLLUTION

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

In 2010, a total of 38,211 industrial sources were subjected to the Environmental Quality (Clean Air) Regulations, 1978. The total number of industrial sources is much higher in 2010 than in 2009 due to the increase in development of industrial and manufacturing sector. The breakdown of industrial sources by states is as shown in **Figure 5.4**. The highest number of stationary pollution sources was in Johor (9,276:24.3%) followed by Selangor (5,431:14.2%) and Sarawak (3,502:9.2%).

As for the past years motor vehicles remain the major contributor of air pollution especially in urban areas. In 2010, there was an overall increase in the number of motor vehicles registered. The number of registered passenger cars increased by 7.16%, motorcycles by 5.61%, buses by 3.86%, goods vehicles by 3.20% and taxis by 6.96% in 2010 compared to 2009. The number of registered vehicles in Malaysia as reported by the Department of Road Transport for the year 2009 and 2010 is as shown in **Figure 5.5**. The number of in-use or active vehicles on the road had shown an increasing trend except for buses and taxis. In 2010, the number of in-use passenger cars increased by 5.73%, motorcycles by 4.63% and goods vehicles by 1.61% while the number of in-use buses and taxis decreased by 6.85% and 1.15% respectively compared to 2009 (**Figure 5.6**).

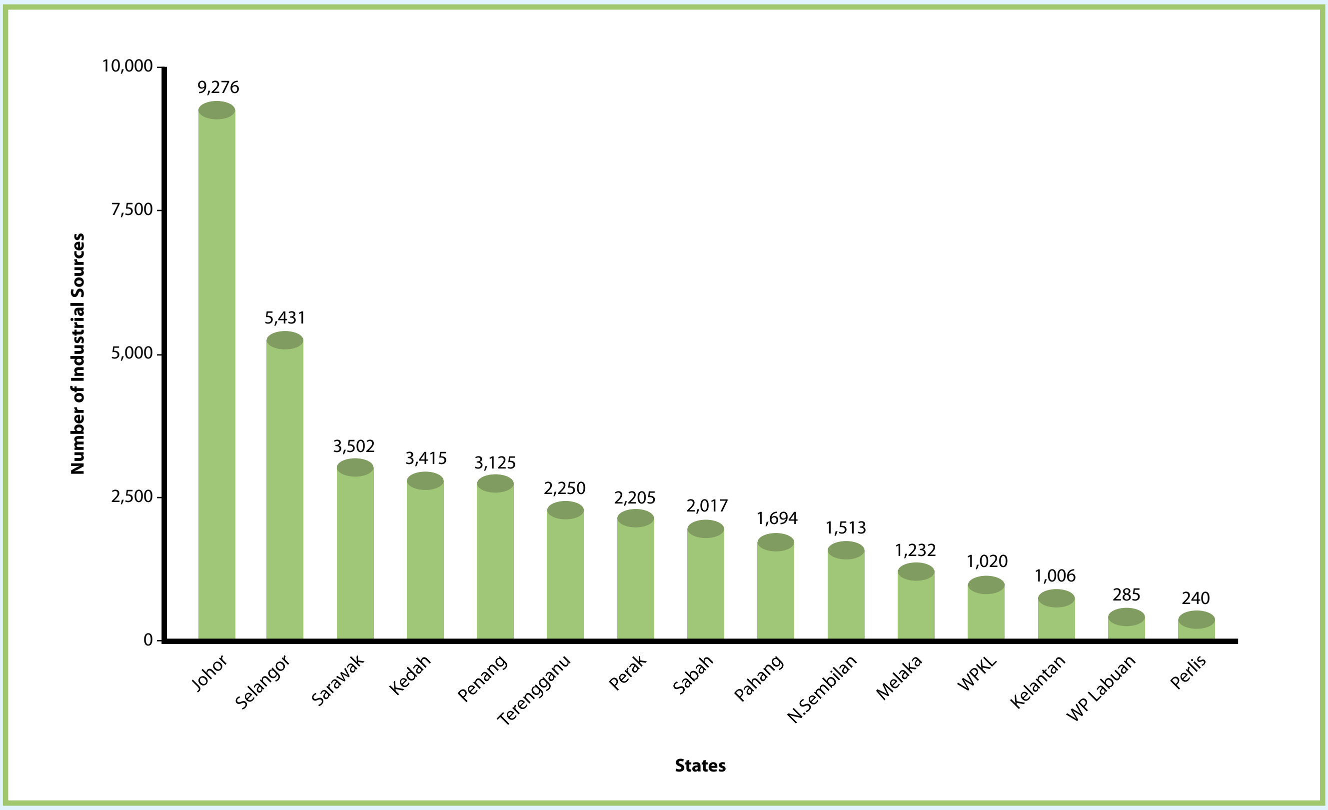


Figure 5.4 Malaysia: Industrial Air Pollution Sources by State, 2010

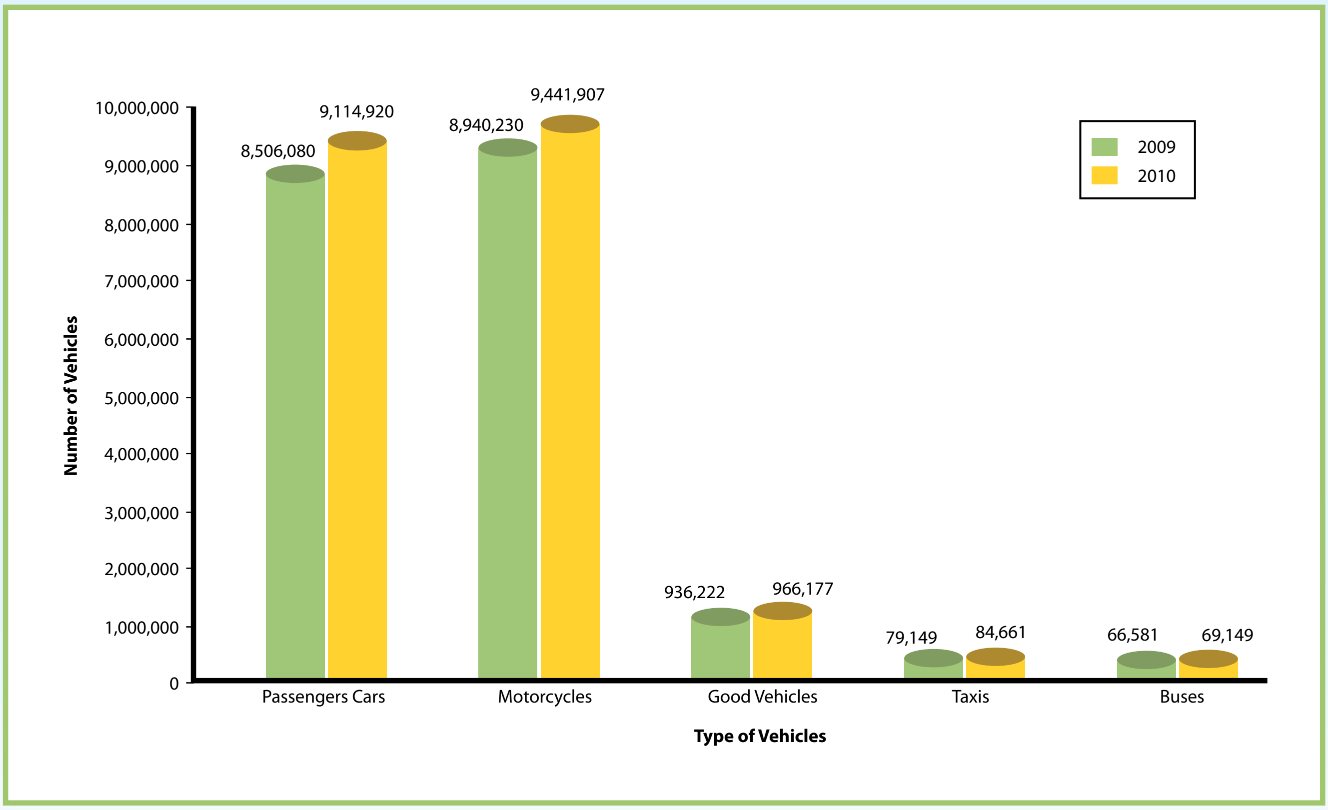


Figure 5.5 Malaysia: Number of Registered Vehicles in 2009 and 2010 (Source: Road Transport Department, Malaysia, 2010)

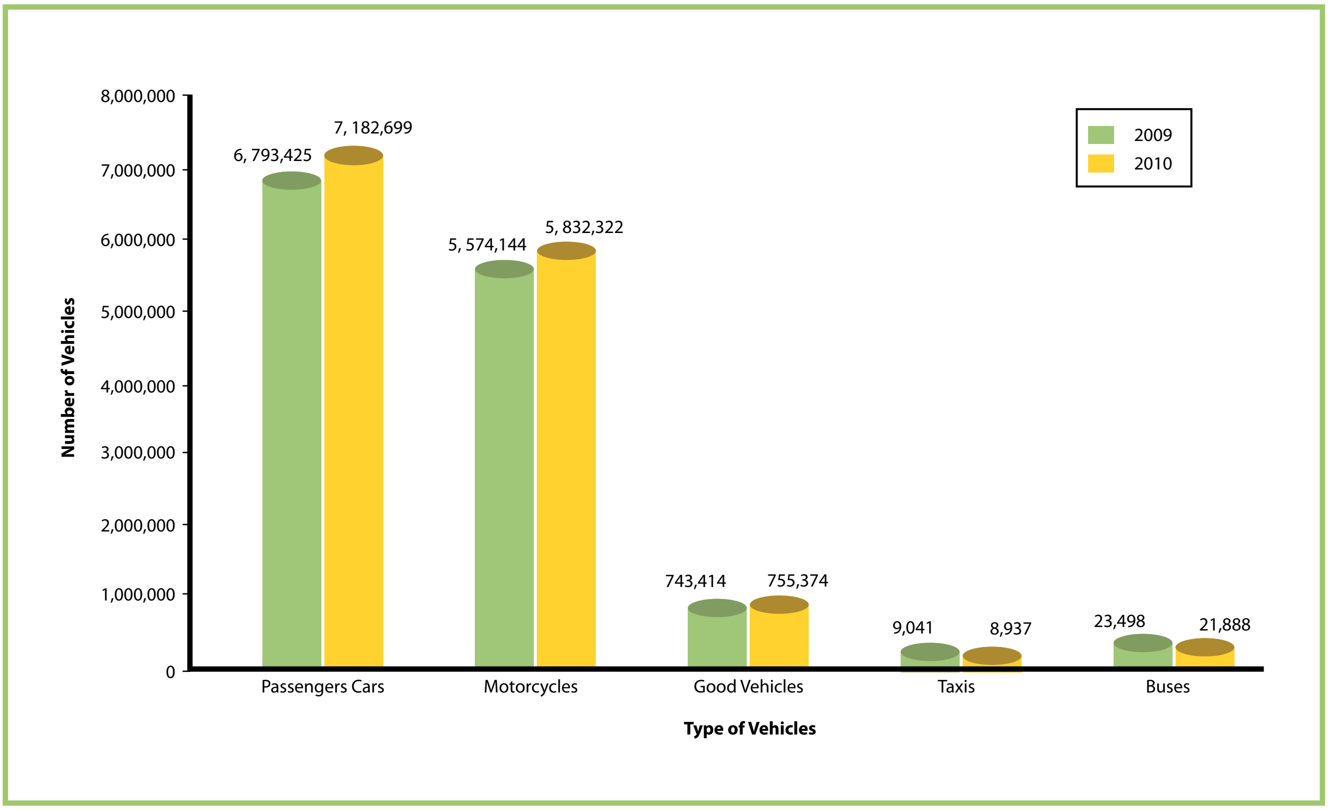


Figure 5.6 Malaysia: Number of In Use Vehicles in 2009-2010
(Source: Road Transport Department, Malaysia, 2010)

AIR POLLUTANT EMISSION LOAD

Overall Emission Load

It is estimated that in 2010 the combined air pollutant emission load was 1,681,440 metric tonnes of carbon monoxide (CO); 740,006 metric tonnes of nitrogen dioxides (NO_2); 174,820 metric tonnes of sulphur dioxide (SO_2) and 26,964 metric tonnes of particulate matter (PM). A comparison of the combined air pollutant emission load in 2009 and 2010 is shown in **Figure 5.7**. In 2010, there was an increase in emission load for CO and SO_2 with an increase of 3.71 percent and 1.69 percent respectively compared to 2009. Meanwhile, there was 2.16 percent decrease in NO_2 emission load and 2.75 percent decrease in PM emission load in 2010 compared to 2009.

Emission Load by Sources

Power plants contributed the highest SO_2 emission load (51%), industries (22%), motor vehicles (8%) and others (19%) (**Figure 5.8**). As to PM the highest contributor was industries (48%) followed by power plants (25%), motor vehicles (17%) and others (10%) (**Figure 5.9**). As shown in **Figure 5.10** the highest contributor of NO_2 was from power plants (61%) followed by motor vehicles (29%), industries (7%) and others (3%). Motor vehicles remain the highest contributor of CO (95%) (**Figure 5.11**).

The estimated annual air pollutant emission loads of HC, CO, PM, NO_2 and SO_2 from motor vehicles for 2009 and 2010 is shown in **Figure 5.12**. In 2010, the emission load of HC and CO was estimated to be 372,924 metric tonnes and 1,597,955 metric tonnes respectively. Except for PM, there was an increase in emission load for HC, CO, SO_2 and NO_2 as compared to 2009.

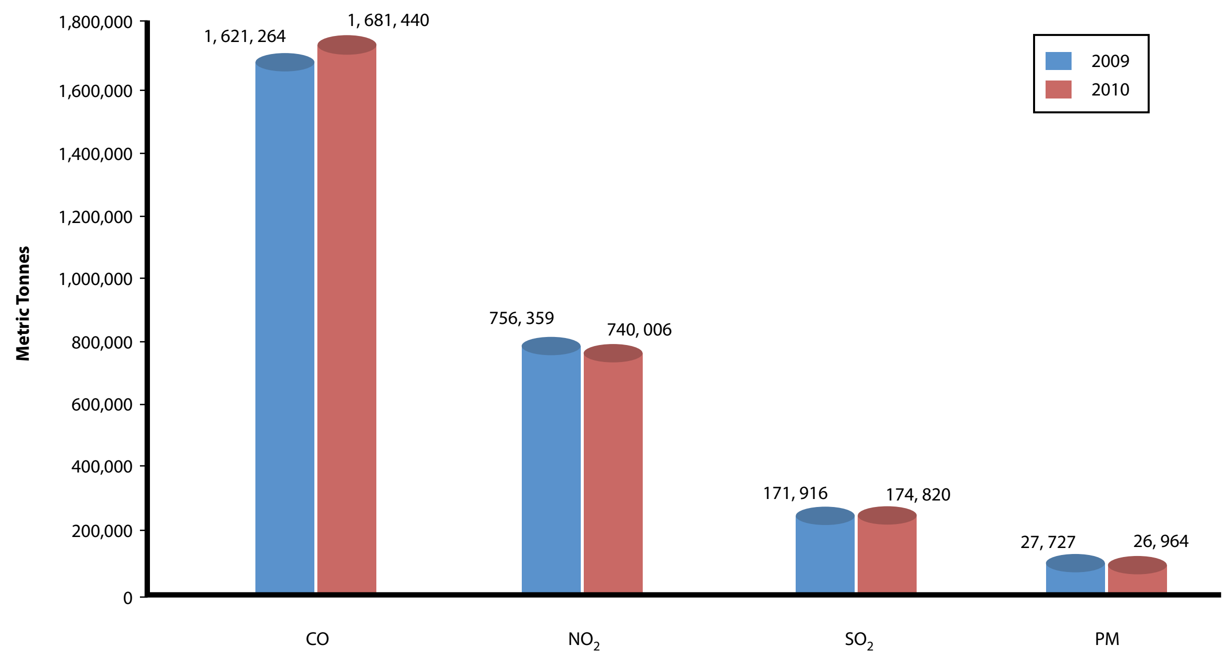


Figure 5.7 Malaysia: Air Pollutant Emission Load from All Sources, 2009-2010
(Sources: From National Energy Balance 2008)

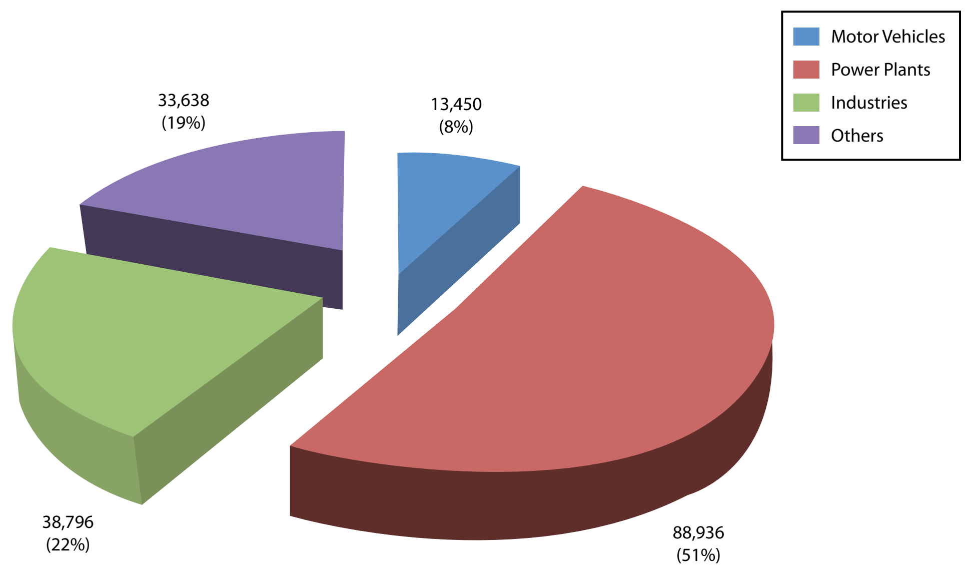


Figure 5.8 Malaysia: SO_2 Emission Load by Sources (Metric Tonnes), 2010

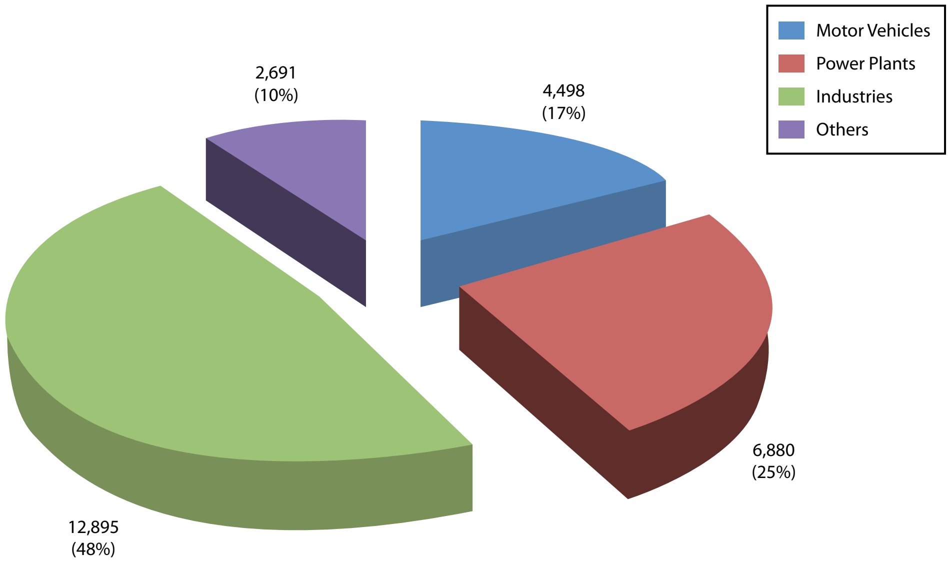


Figure 5.9 Malaysia: Particulate Matter (PM) Emission Load by Sources (Metric Tonnes), 2010

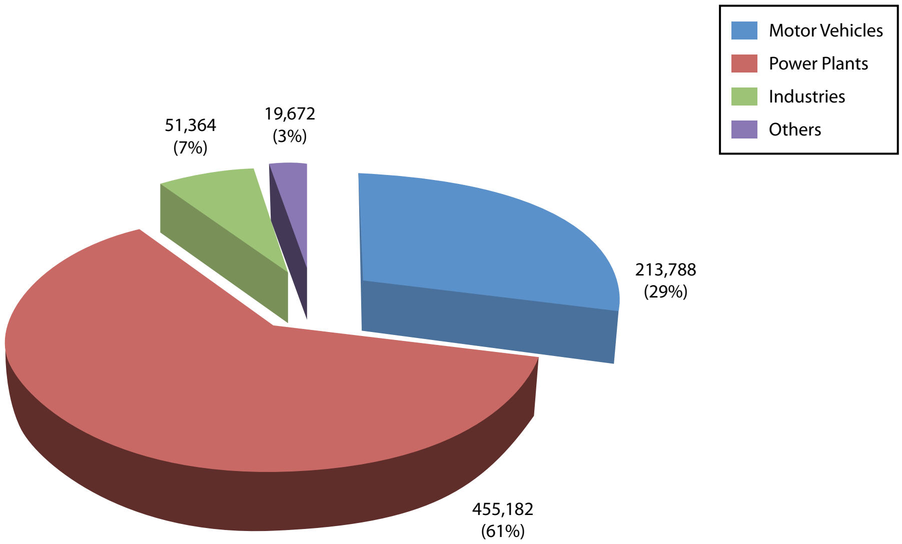


Figure 5.10 Malaysia: NO_2 Emission Load by Sources (Metric Tonnes), 2010

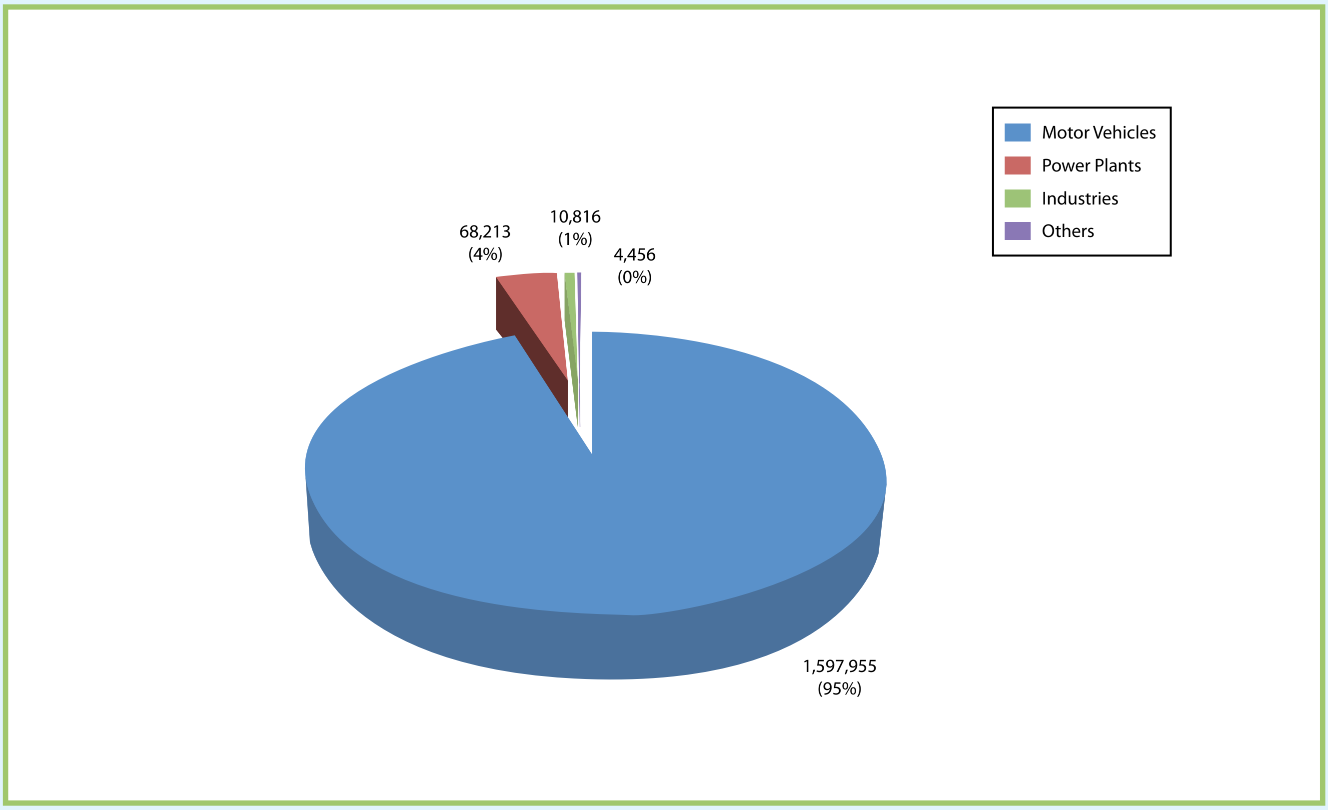


Figure 5.11 Malaysia: CO Emission Load by Sources (Metric Tonnes), 2010

Figure 5.12 Malaysia: Air Pollutant Emission Load from Motor Vehicles, 2009-2010.

SCHEDULED WASTES INVENTORY

Based on the notification on scheduled wastes received by Department of Environment (DOE), a total of 1,880,928.53 metric tonnes of scheduled wastes were generated in 2010 as compared to 1,705,308.14 metric tonnes in 2009. In 2010, it was found that dross/slag/clinker/ash, heavy metal sludge, gypsum, e-waste and mineral sludge were the main categories of waste produced in the country. The breakdown according to waste categories and industry type are given in **Table 5.2, 5.3 and Figure 5.13**, **5.14** respectively. In addition to this, a total of 1,206,568.31 metric tonnes of scheduled wastes were generated and managed under the special management approval as stipulated under Regulation 7, Environmental Quality (Scheduled Wastes) Regulations, 2005. These waste streams were mostly generated from power stations (49.54%), drinking water treatment plants (36.47%) and others (13.98%) (**Table 5.5**).

Proper handling of electronic waste

Based on scheduled waste generated in **Table 5.2**, industries in Terengganu produced the largest amount of scheduled wastes (26.9%), followed by Johor (15.7%), Pulau Pinang (14.5%), Perak (12%), and Selangor (11.2%). Distribution of scheduled wastes generated by state is shown in **Figure 5.15**.

Of the total wastes produced, 133,674.17 metric tonnes (7.11%) were treated and disposed at Kualiti Alam Sdn. Bhd., 12,161.00 metric tonnes (0.65%) were treated and disposed at Trinekens (Sarawak) Sdn. Bhd., 16,781.08 metric tonnes (0.89%) of clinical wastes were incinerated at licensed off-site facilities, 1,517.00 metric tonnes (0.08%) were exported for recovery purposes, 875,972.38 metric tonnes (46.57%) of scheduled wastes were recovered at off-site facilities; an estimated 805,365.94 metric tonnes (42.82%) were treated on-site and 35,456.96 metric tonnes (1.89%) were stored on-site at waste generators' premises (**Table 5.4**). Two (2) landfarms for on-site treatment and 21 on-site waste incinerators had been licensed by DOE.

Table 5.2 Malaysia: Quantity of Scheduled Wastes Generated by Industry, 2010

No	Type of Industry	Quantity of Waste	
		MT/year	Percentage (%)
1	Chemical	765,208.44	40.68
2	Electronic / Electrical	274,582.79	14.60
3	Licensed Facilities	260,636.76	13.86
4	Metal / Engineering	166,938.06	8.88
5	Automotive/Workshop	107,020.65	5.69
6	Hospital/Pharmaceutical	45,075.48	2.40
7	Petroleum / Petrochemical	43,847.93	2.33
8	Rubber Based	39,585.25	2.10
9	Paper Based	32,899.77	1.75
10	Shipping	32,248.85	1.71
11	Water Treatment Plant / Power Station	31,002.98	1.65
12	Printing & Packaging	27,328.96	1.45
13	Paint	11,625.64	0.62
14	Food	7,249.56	0.39
15	Industrial Gas	6,523.58	0.35
16	Glass / Crystal	6,385.19	0.34
17	Others	5,700.75	0.30
18	Mineral / Ceramic / Tiles / Plaster	3,769.56	0.20
19	Batteries	3,593.98	0.19
20	Plastic	2,622.70	0.14
21	Photographic	2,114.11	0.11
22	Electroplating/Coating	1,564.49	0.08
23	Textile	1,197.97	0.06
24	Wood Based	1,066.04	0.06
25	Oleochemical	427.61	0.02
26	Cement Based	309.74	0.02
27	Asbestos	259.22	0.01
28	Quarry	142.47	0.01
	Total	**1,880,928.53**	**100.00**

Table 5.3 Malaysia : Quantity of Scheduled Wastes Generated by Category, 2010

No	Waste Category	Waste Code	Quantity of Waste	
			MT/Year	Percentage (%)
1	Gypsum	SW (205)	630,623.79	33.53
2	E-Waste	SW (110)	163,339.80	8.68
3	Heavy Metal Sludge	SW (204,105,108)	157,381.38	8.37
4	Dross / Slag / Clinker / Ash	SW (104,107,406)	154,223.11	8.20
5	Mineral Sludge	SW (427)	123,898.54	6.59
6	Asbestos	SW (201)	107,587.66	5.72
7	Oil & Hydrocarbon	SW (305, 306, 307, 308, 309, 310, 311, 312, 314, 315, 415)	106,939.39	5.69
8	Acid & Alkali	SW (206, 401)	97,360.65	5.18
9	Mixed Wastes	SW (422, 421)	76,635.68	4.07
10	Clinical/Pharmaceutical	SW (404, 403, 405)	42,029.33	2.23
11	Ink & Paint Sludge	SW (416, 417, 418)	40,447.96	2.15
12	Used Containers	SW (409)	35,150.90	1.87
13	Rubber Sludge	SW (321)	29,553.51	1.57
14	Spent Solvent	SW (322,323)	26,239.48	1.40
15	Residue	SW (501)	18,604.62	0.99
16	Batteries	SW (319,320)	18,018.87	0.96
17	Paper & Plastic	SW (102,103)	15,830.79	0.84
18	Phenol / Spent Adhesive / Spent Resin	SW (410)	12,620.58	0.67
19	Catalyst	SW (202)	6,731.39	0.36
20	Expired Drug	SW (403)	5,376.76	0.29
21	Others	NA	4,977.57	0.26
22	Contaminated Land/Soil	SW (408)	3,310.41	0.18
23	Peroxide Agent	SW (424)	1,168.22	0.06
24	Contaminated Active Carbon	SW (411)	997.13	0.05
25	Photographic Waste	SW (423)	804.75	0.04
26	Chemical Waste	SW (430, 429)	745.85	0.04
27	Mercury	SW (109)	246.51	0.01
28	Arsenic	SW (101)	60.72	0.00
30	Sludge Contain Cyanide	SW (412)	23.19	0.00
	Total		**1,880,928.53**	**100.00**

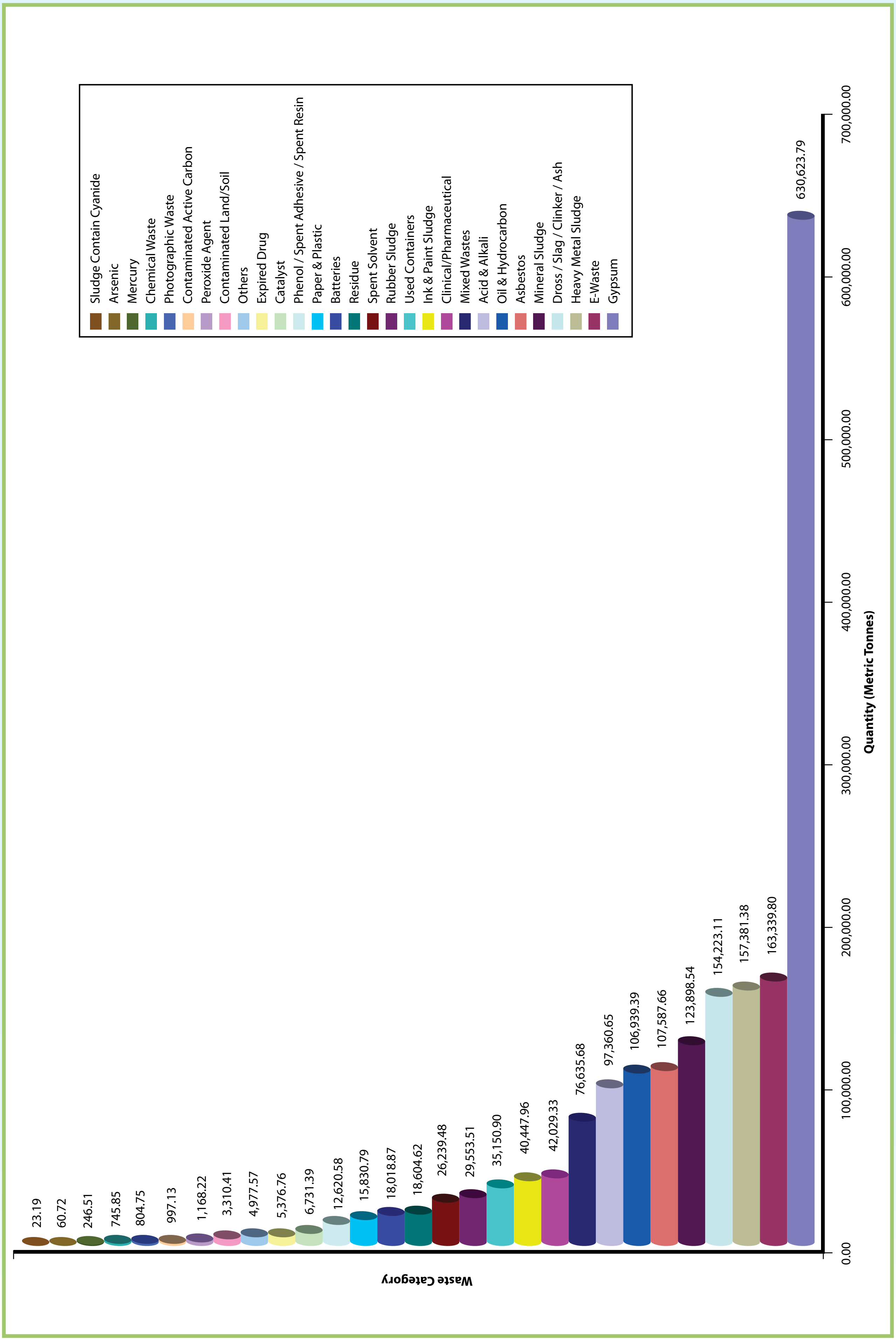


Figure 5.13 Malaysia : Quantity of Scheduled Wastes Generated by Category, 2010

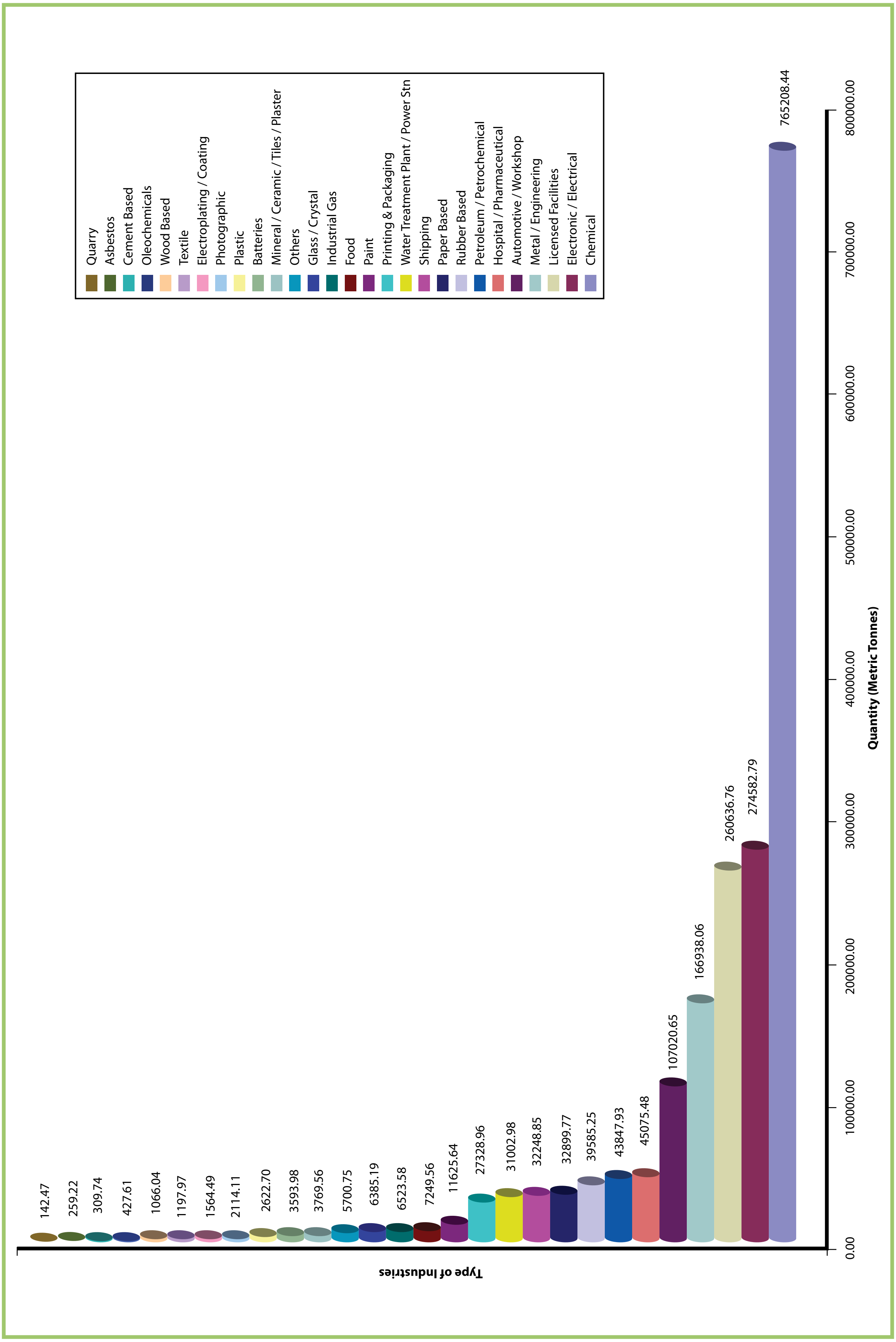


Figure 5.14 Malaysia : Quantity of Scheduled Wastes Generated by Industry, 2010

Table 5.4 Malaysia : Facilities Handling Scheduled Wastes, 2010

No.	Facility	Tonnes	Percentage (%)
1	Local Off-site Recovery Facilities	875,972.38	46.57
2	On-site Treatment	805,365.94	42.82
3	Kualiti Alam Sdn. Bhd	133,674.17	7.11
4	On-site Storage	35,456.96	1.89
5	Off-site Clinical Waste Incinerators	16,781.08	0.89
6	Trinekens (Sarawak) Sdn. Bhd.	12,161.00	0.65
7	Foreign Facilities (Export)	1,517.00	0.08
	Total	**1,880,928.53**	**100.00**

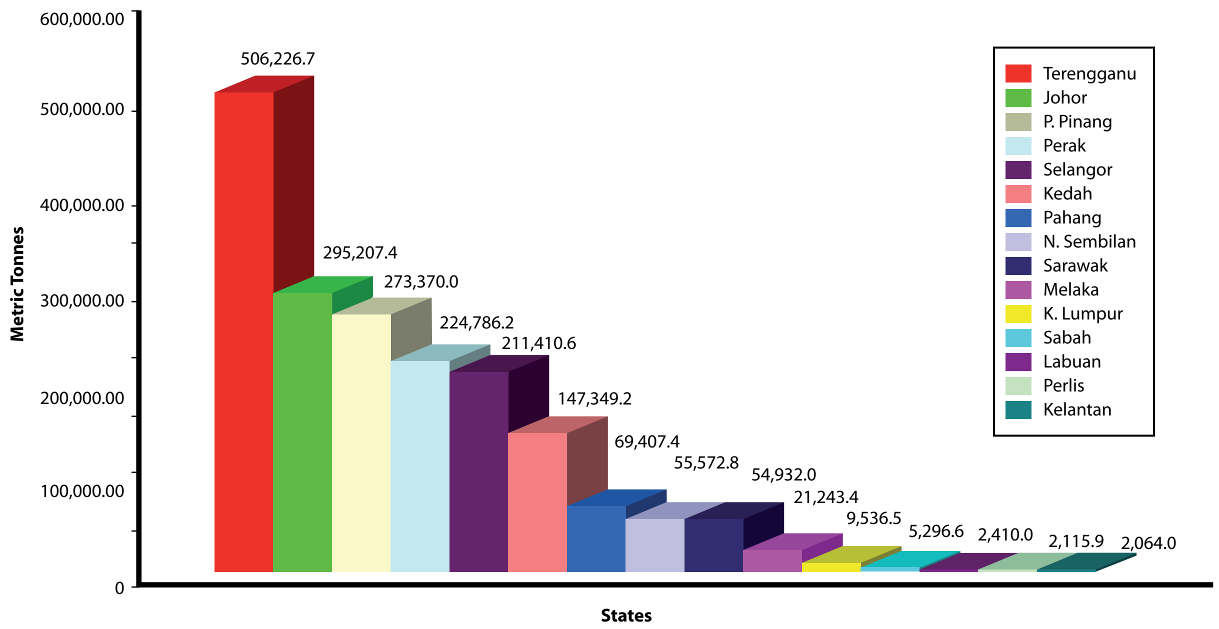


Figure 5.15 Malaysia: Distribution of Scheduled Wastes Generated By State, 2010

Of the 875,972.38 metric tonnes of wastes being recovered at local off-site recovery facilities, 38.3% are electronic and electrical wastes followed by dross/ash/slag/catalyst (12.5%), oil/mineral sludge/spent coolant (9.5%) and used containers/ contaminated waste/ ink/ paint/ lacquer (9.3%). (**Table 5.6**).

A total of 399 off-site recovery facilities have been licensed by the department to recover various categories of scheduled wastes.

The categories of wastes sent to the licensed premises (Kualiti Alam Sdn.Bhd and Trienekens (Sarawak) Sdn.Bhd.) for final disposal are sludge containing one or several metals, mixed wastes, dust/slag/dross/or ash containing arsenic/mercury and spent inorganic acid. They were either incinerated, treated physically and chemically, solidified or disposed off in secured landfill (**Figure 5.16**).

For the scheduled waste managed under the special waste management, the wastes were mostly from power generation stations. The waste streams generated from power stations were 49.54% followed by drinking water treatment plants (36.47%) (**Table 5.5**). Of the 1,206,568.31 metric tonnes of scheduled waste managed under the special waste management, 50.34% were reused as raw material in industries and the rest (49.64%) were disposed at approved sanitary landfill.

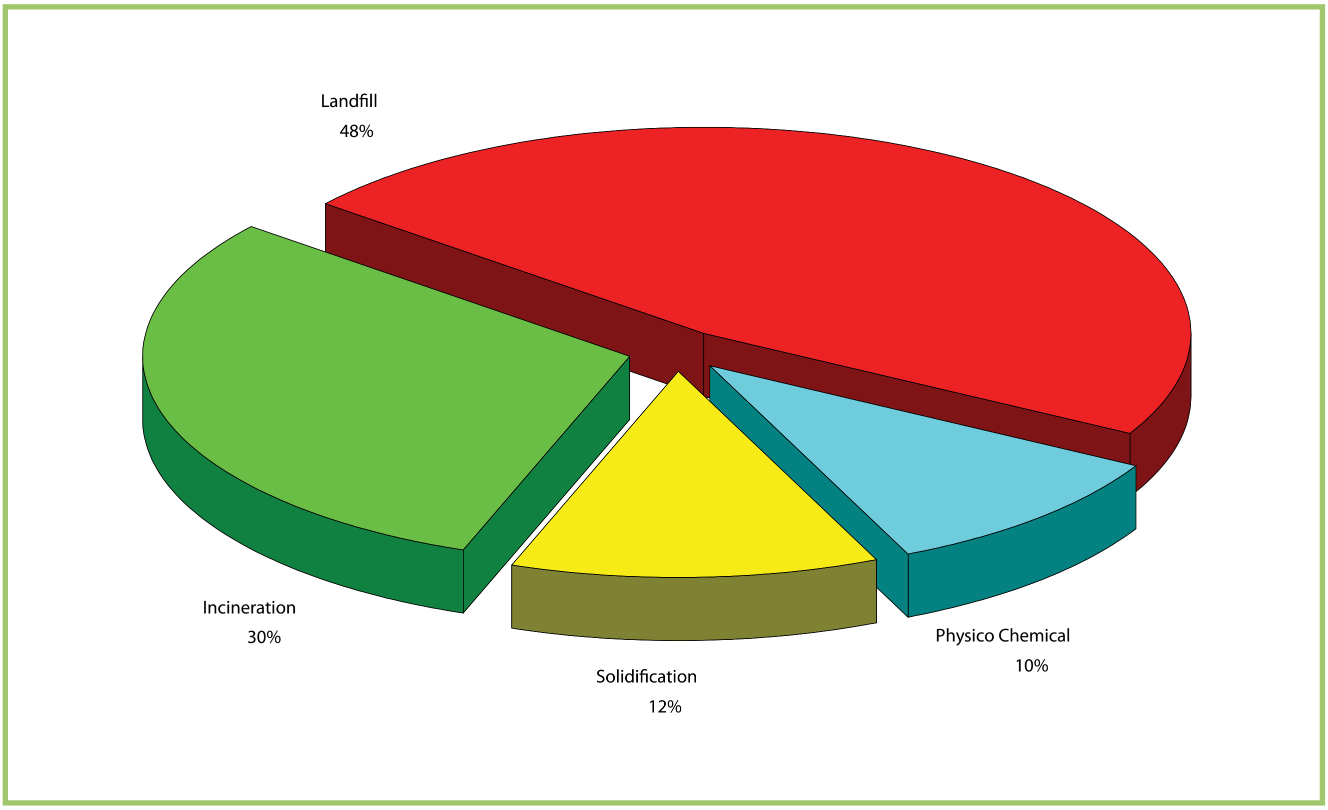


Figure 5.16 Malaysia: Types of Treatment and Disposal of Waste, 2010

Table 5.5 Malaysia: Generated Scheduled Waste Managed Under Special Management

No	Waste Category	Waste Code	Source	Tonnes	Percentage (%)	Method of Disposal
1	Sludge Containing Heavy Metal	SW 204	Drinking Water Treatment Plant	440,094.00	36.47	Sanitary Landfill
			Industry	92,314.22	7.65	
2	Fly Ash	SW 104	Coal - Fired Power Plant	597,744.86	49.54	Reuse at Non Prescribed Premises
			Industry	9,077.03	0.75	
3	Gypsum	SW 205	Industry	55,545.73	4.60	Sanitary Landfill
4	Glue	SW 303	Industry	100.08	0.01	Reuse at Non Prescribed Premises
5	Petroleum By - Product	SW 320	Industry	515.87	0.04	Reuse at Non Prescribed Premises
6	Waste Containing Formaldehyde, Resin, Discarded Epoxy Powder	SW 322, SW 325, SW 418	Industry	5,447.21	0.45	Sanitary Landfill
7	Discarded Pharmaceutical Product, Discarded Toner	SW 405, SW 417	Industry	249.73	0.02	Sanitary Landfill
8	Ash of Paper Sludge	SW 406	Industry	5,479.58	0.45	Sanitary Landfill
Total				**1,206,568.31**	**100.00**	

Table 5.6 Malaysia: Off-site Recovery Facilities and Quantity of Waste Handling, 2010

Waste Category	Recovery Facility	Percentage (%)
Electronic and Electrical Wastes	153	38.3
Dross / Ash / Slag / Catalyst	50	12.5
Oil / Mineral Sludge / Spent Coolant	38	9.5
Used Container / Contaminated Waste / Ink / Paint / Lacquer	37	9.3
Heavy Metal Sludge / Rubber	30	7.5
Acid / Alkaline	28	7.0
Solvent	23	5.8
Phenol / Adhesive / Resin	15	3.8
Photographic	10	2.5
Gypsum	8	2.0
Battery	7	1.8
Total	**399**	**100.0**

ANNEX

National Water Quality Standards For Malaysia

PARAMETER	UNIT	CLASS				
		I	IIA/IIB	III#	IV	V
Al	mg/l	NATURAL LEVELS OR ABSENT	-	(0.06)	0.5	LEVELS ABOVE IV
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	
Mn	mg/l		0.1	0.1	0.2	
Hg	mg/l		0.001	0.004 (0.0001)	0.002	
Ni	mg/l		0.05	0.9*	0.2	
Se	mg/l		0.01	0.25 (0.04)	0.02	
Ag	mg/l		0.05	0.0002	-	
Sn	mg/l		-	0.004	-	
U	mg/l		-	-	-	
Zn	mg/l		5	0.4*	2	
B	mg/l		1	(3.4)	0.8	
Cl	mg/l		200	-	80	
Cl_2	mg/l		-	(0.02)	-	
CN	mg/l		0.02	0.06 (0.02)	-	
F	mg/l		1.5	10	1	
NO_2	mg/l		0.4	0.4 (0.03)	-	
NO_3	mg/l		7	-	5	
P	mg/l		0.2	0.1	-	
Silica	mg/l		50	-	-	
SO_4	mg/l		250	-	-	
S	mg/l		0.05	(0.001)	-	
CO_2	mg/l		-	-	-	
Gross-α	Bq/l		0.1	-	-	
Gross-β	Bq/l		1	-	-	
Ra-226	Bq/l		< 0.1	-	-	
Sr-90	Bq/l		< 1	-	-	
CCE	μg/l		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 * I x – 2 I	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*

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