



MALAYSIA
ENVIRONMENTAL
QUALITY REPORT

2012



DEPARTMENT OF ENVIRONMENT
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT



MALAYSIA ENVIRONMENTAL QUALITY REPORT

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MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT



DEPARTMENT OF ENVIRONMENT, MALAYSIA

Department Of Environment, Malaysia

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FOREWORD

“ Environmental Conservation, Our Shared Responsibility ”

Dato' Halimah Hassan
Director General of Environmental Quality
Malaysia



It is my pleasure to present the Environmental Quality Report 2012 as required under Section 3(1)(i) of the Environmental Quality Act 1974.

The river water quality in terms of WQI had shown a slight improvement in 2012. The percentage of clean rivers of 59% in 2012 remained unchanged as compared to the previous year. However, the percentage of polluted river has decreased from 8% in previous year to 7%. The quality of the marine environment with respect to coastal and estuarine areas was 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 2012 was between good to moderate levels most of the time. The overall number of good air quality days increased in 2012 (57 percent of the time) compared to that in 2011 (55 percent of the time) while remaining 42 percent at moderate level and one (1) percent at unhealthy level. However, the country experienced several short spell of haze episodes due to transboundary air pollution as a result of forest fire from Central and Northern Sumatra, Indonesia which occurred during the dry period from June to August 2012.

The Department has always been committed to conserving and protecting the environment. However, the mammoth task and responsibility of ensuring that our natural resources and environment continue to be conserved and used sustainably cannot be shouldered solely by the DOE alone. It requires the involvement of all.

A handwritten signature in black ink, appearing to read 'Halimah', written in a cursive style.

Dato' Halimah Hassan
Director General of Environmental Quality
Malaysia
30 August 2013

CHAPTER 1



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, sub urban 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 (PM₁₀) 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 (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and particulate matter of less than 10 microns in size (PM₁₀).

The API is categorized as good, moderate, unhealthy, very unhealthy and hazardous as presented in **Table 1.1**.

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





Legend

- Industrial
- Background
- Urban
- Sub Urban



Map 1.1 Malaysia: Location of Continuous Air Quality Monitoring Stations in Peninsular Malaysia, 2012



Map 1.2 Malaysia: Location of Continuous Air Quality Monitoring Stations in Peninsular Malaysia, 2012

AIR QUALITY STATUS

Based on the Air Pollutant Index (API), the overall air quality for Malaysia in 2012 was between good to moderate levels most of the time. The overall number of good air quality days increased in 2012 (57 percent of the time) compared to that in 2011 (55 percent of the time) while remaining 42 percent at moderate level and one (1) percent at unhealthy level.

However, the country experienced several short spell of haze episodes due to transboundary air pollution as a result of forest fire from Central and Northern Sumatra, Indonesia which occurred during the dry period of June to August 2012.

These had contributed to the slight deterioration of overall air quality in 2012. The local peat fire in Miri has resulted in high level of PM₁₀ recorded at the ILP Miri Station, Sarawak for a short period between the month of June to August 2012.

Relatively, the annual average concentrations of air pollutants measured namely CO, NO₂, O₃, SO₂ and PM₁₀ were found to be below the stipulated levels of the Malaysian Ambient Air Quality Guidelines (**Table 1.2**).

Table 1.2 Malaysia : Ambient Air Quality Guidelines

POLLUTANT	AVERAGING TIME	MALAYSIA GUIDELINES	
		ppm	(µg/m ³)
Ozone	1 Hour	0.10	200
	8 Hours	0.06	120
Carbon Monoxide	1 Hour	30.0	35**
	8 Hours	9.0	10**
Nitrogen Dioxide	1 Hour	0.17	320
	24 Hours	0.04	
Sulphur Dioxide	1 Hour	0.13	350
	24 Hours	0.04	105
Particulate Matter	24 Hours		150
	12 Months		50
Total Suspended Particulate (TSP)	24 Hours		
	12 Months		
Lead	3 Months		1.5

Note : ** mg/m³

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

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

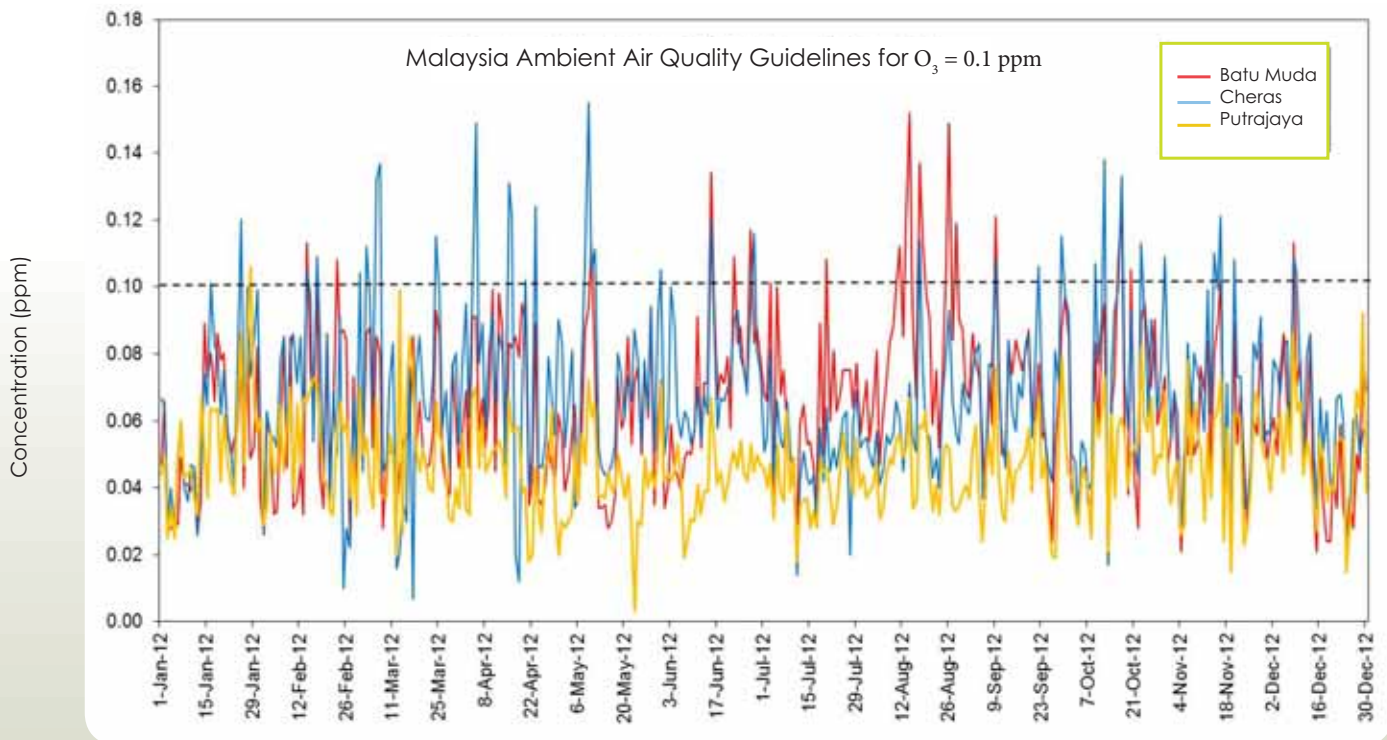


Figure 1.1 (a) Malaysia : Trend of Daily Maximum 1- hour Concentration of Ozone (O_3), Klang Valley, 2012

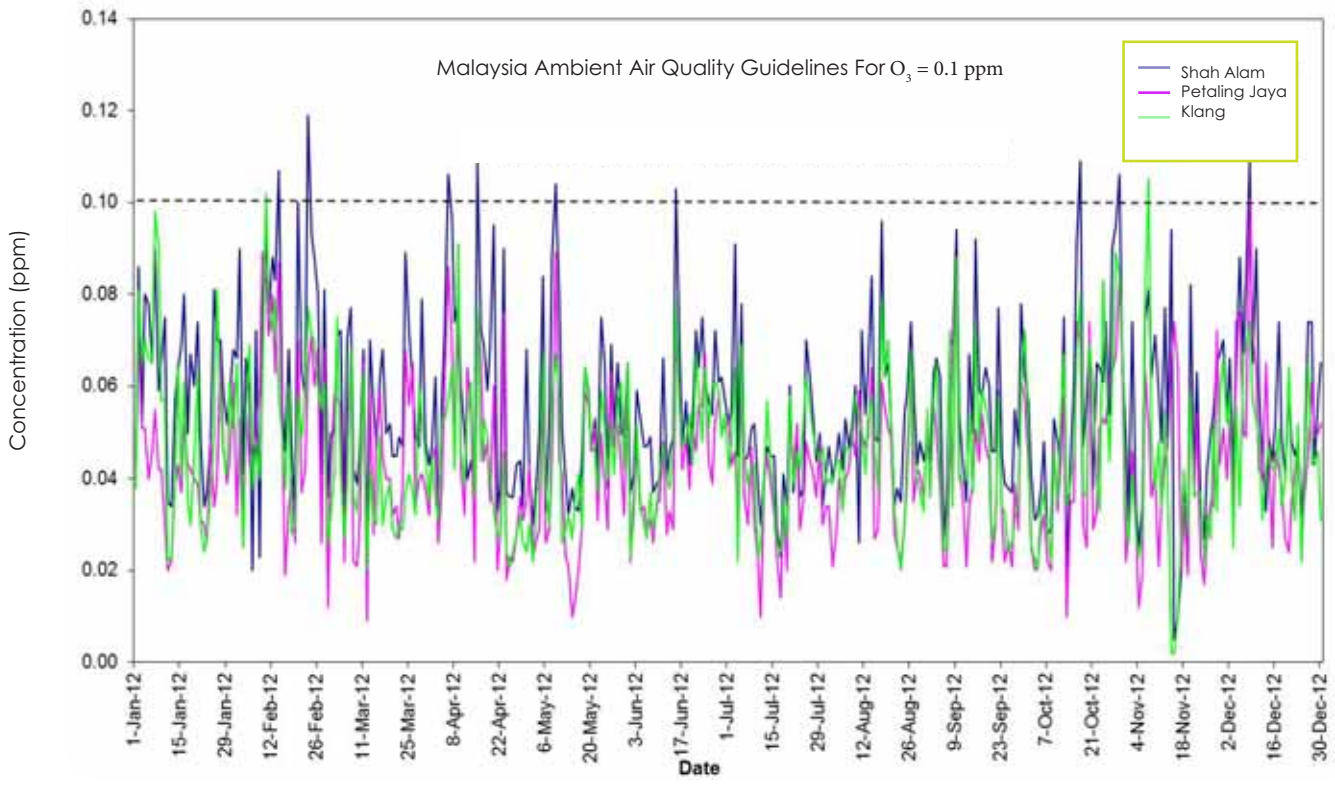


Figure 1.1 (b) Malaysia : Trend of Daily Maximum 1- hour Concentration of Ozone (O_3), Klang Valley, 2012

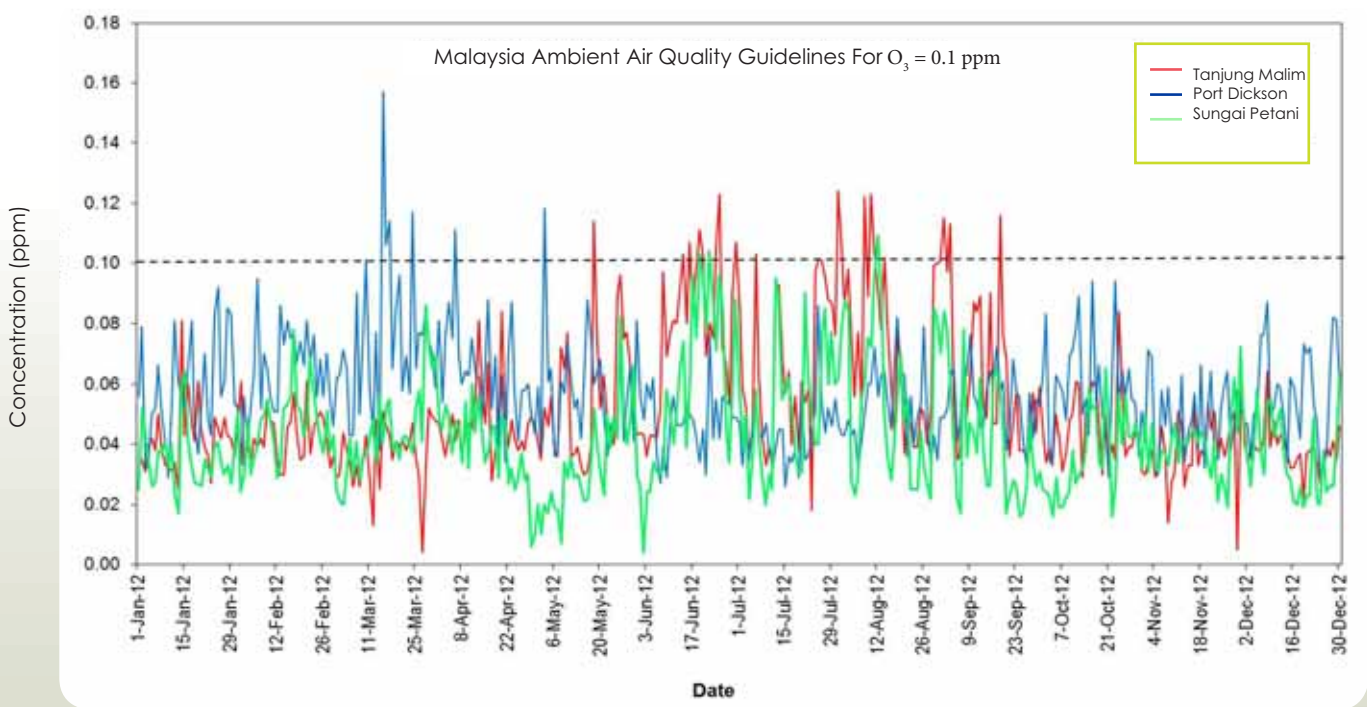


Figure 1.1 (c) Malaysia : Trend of Daily Maximum 1- hour Concentration of Ozone (O_3), Klang Valley, 2012

During the period of June to August 2012, local peat fire in Miri which is very close to the monitoring station at ILP, Miri had resulted to API reading at very unhealthy level for several days. However, the peat fires was under controlled and the deterioration of air quality was localized.

Another haze episode occurred on 16 June 2012 where all stations (8 stations) in Klang Valley had reached unhealthy level with the highest API recorded was 158 in Port Klang which was due to transboundary haze pollution as a result of forest fires in Central and Northern Sumatra.

The overall trend of air quality for Klang Valley in 2012 had shown slight deterioration as compared to 2011 as shown in **Figure 1.1(d)**.

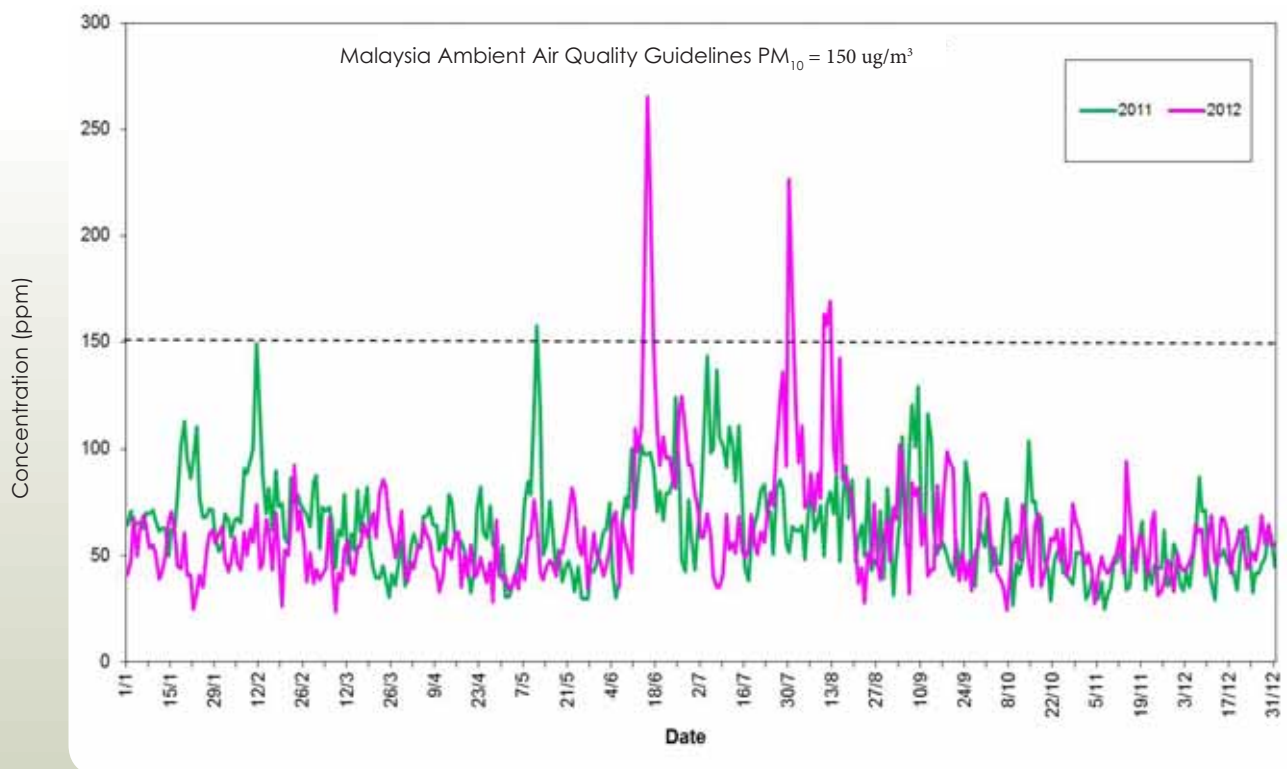
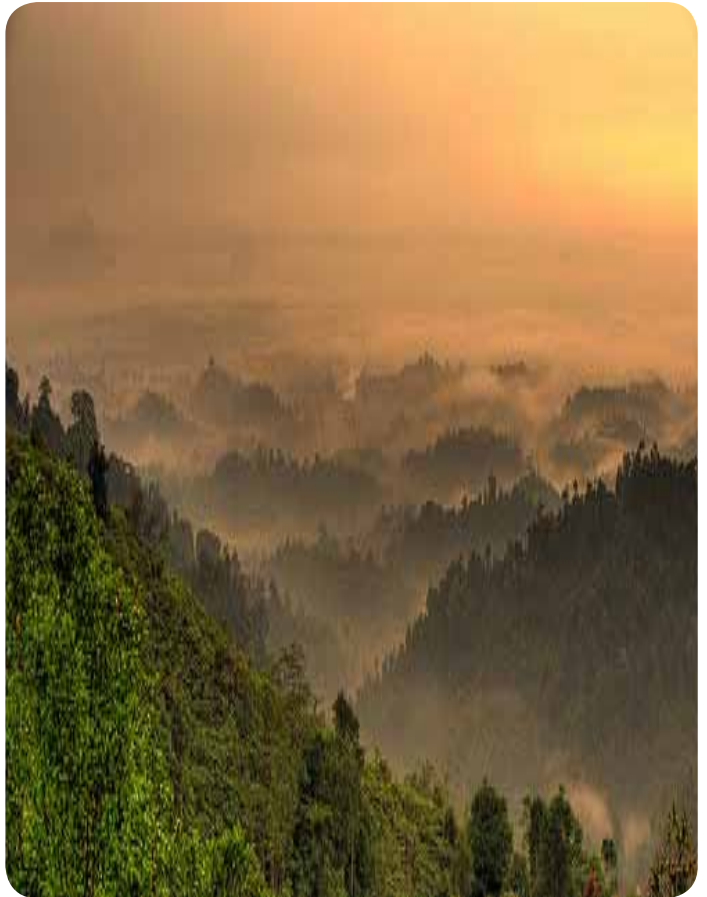


Figure 1.1 (d) : Trend of 24-hour Concentration of Particulate Matter (PM_{10}), Klang ,2011 and 2012

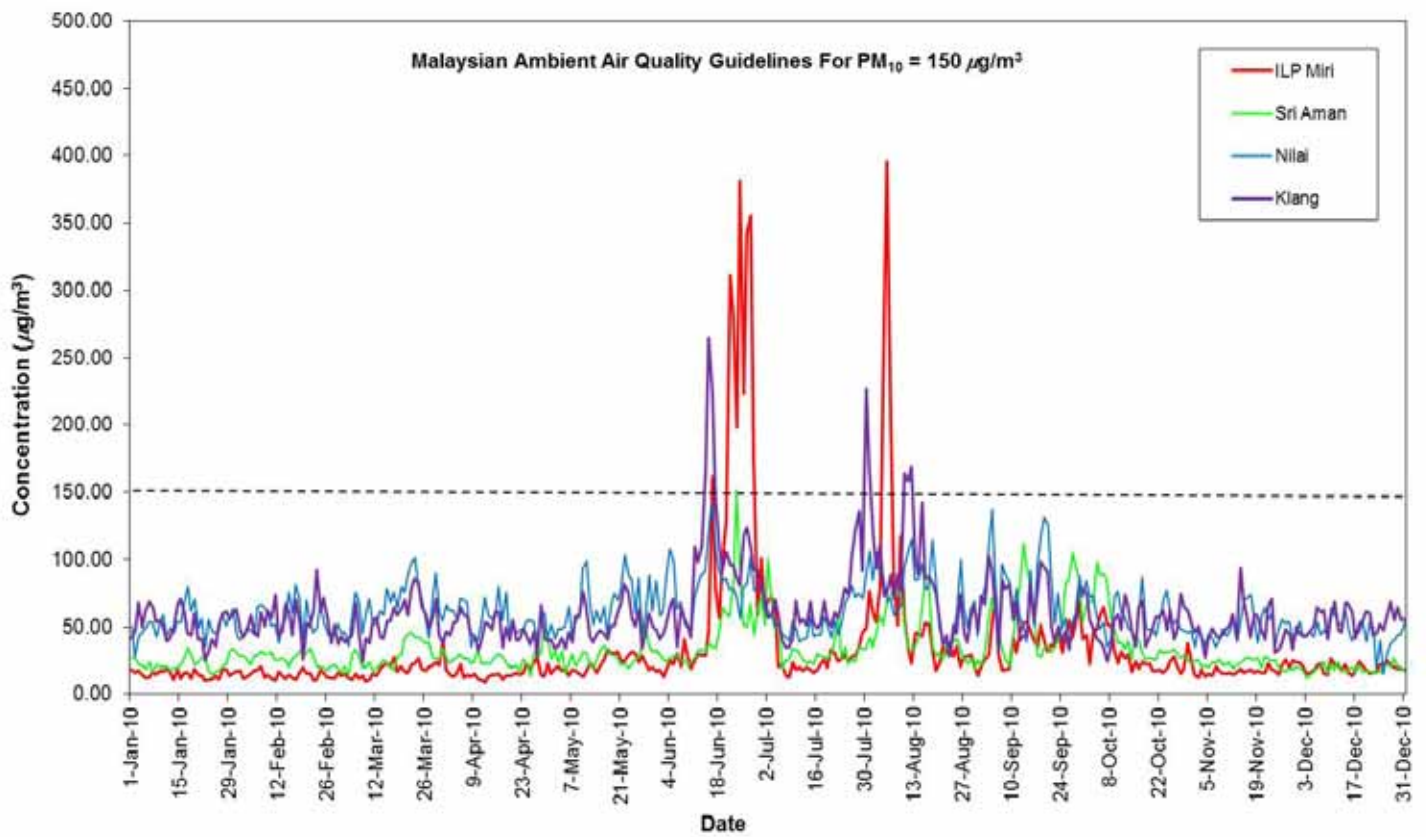


Figure 1.1 (e) Malaysia : Trend of 24-Hour Concentration of Particulate Matter (PM_{10}), Malaysia 2012

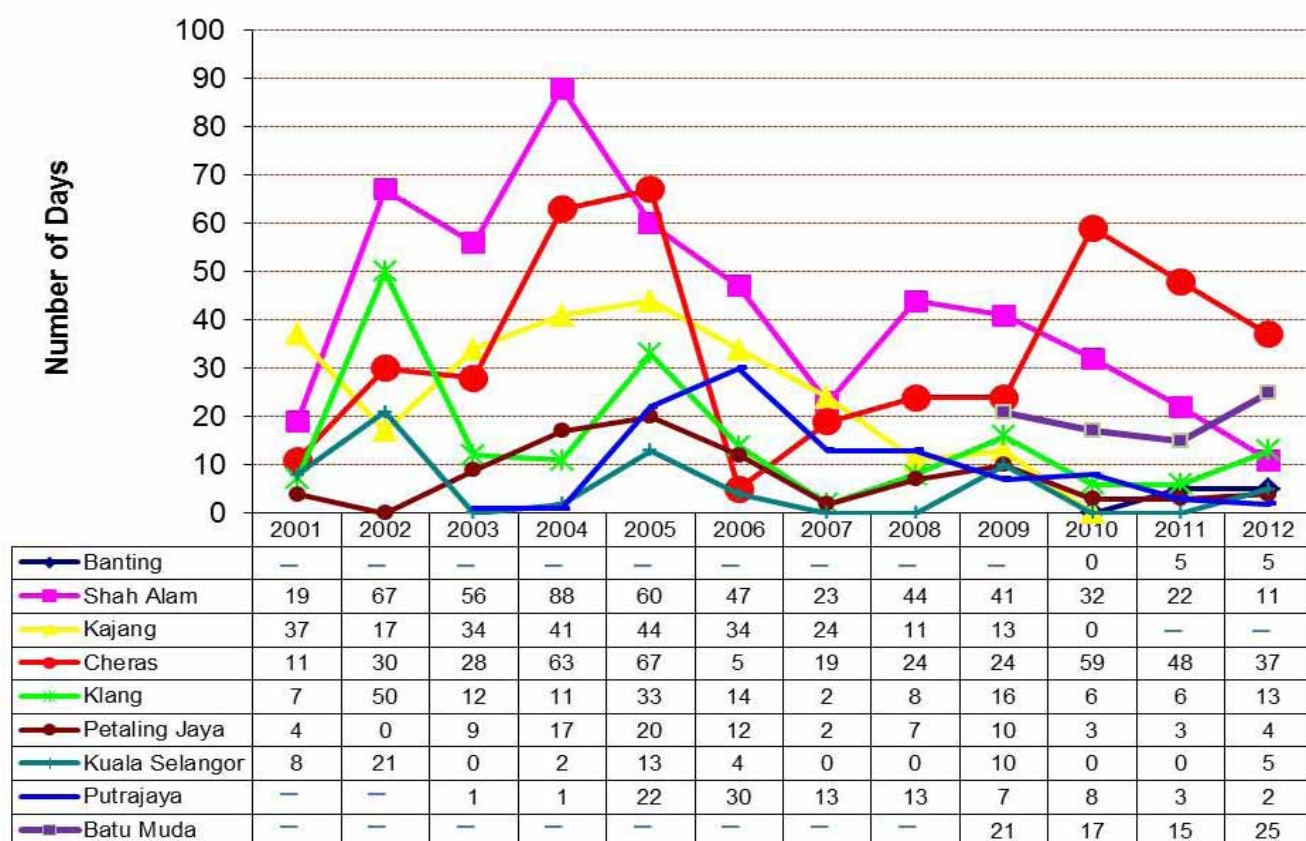


AIR QUALITY STATUS IN THE WEST COAST

KLANG VALLEY

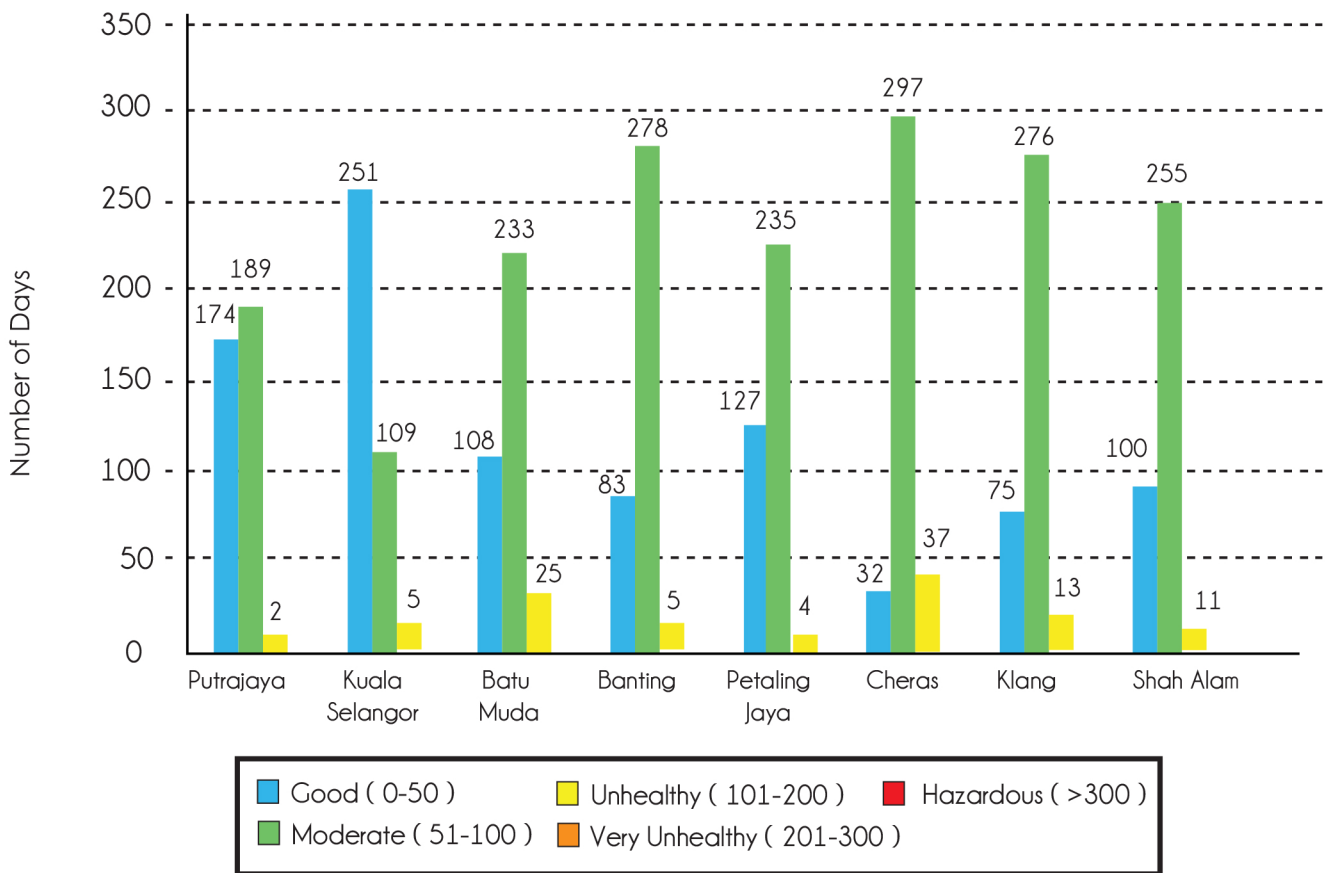
In 2012, the air quality in the Klang Valley ranges most of time 97 percent from good to moderate level with 3 percent was at unhealthy level. The most number of unhealthy days were recorded in Cheras, Kuala Lumpur for 37 days (Figure 1.1) which was better as compared to 48 days in 2011. The unhealthy days recorded were mostly due to the ground level ozone (O₃) pollution. The number of unhealthy days in Shah Alam is 11 days, also better compared to 22 days in 2011. Putrajaya has also improved, only 2 days of unhealthy days compared to 3 days of unhealthy days in 2011.

However, the number of unhealthy days in Batu Muda had increased from 15 days in 2011 to 25 days in 2012. It was also recorded that the air quality in Kuala Selangor deteriorated with five (5) unhealthy days in 2012 compared to none in 2011. The overall air quality status in Klang Valley is shown in Figure 1.2.



Note: Reading based on daily Maximum API

Figure 1.1 Malaysia : Number of Unhealthy Days, Klang Valley, 2001 - 2012



Note: Reading based on daily Maximum API

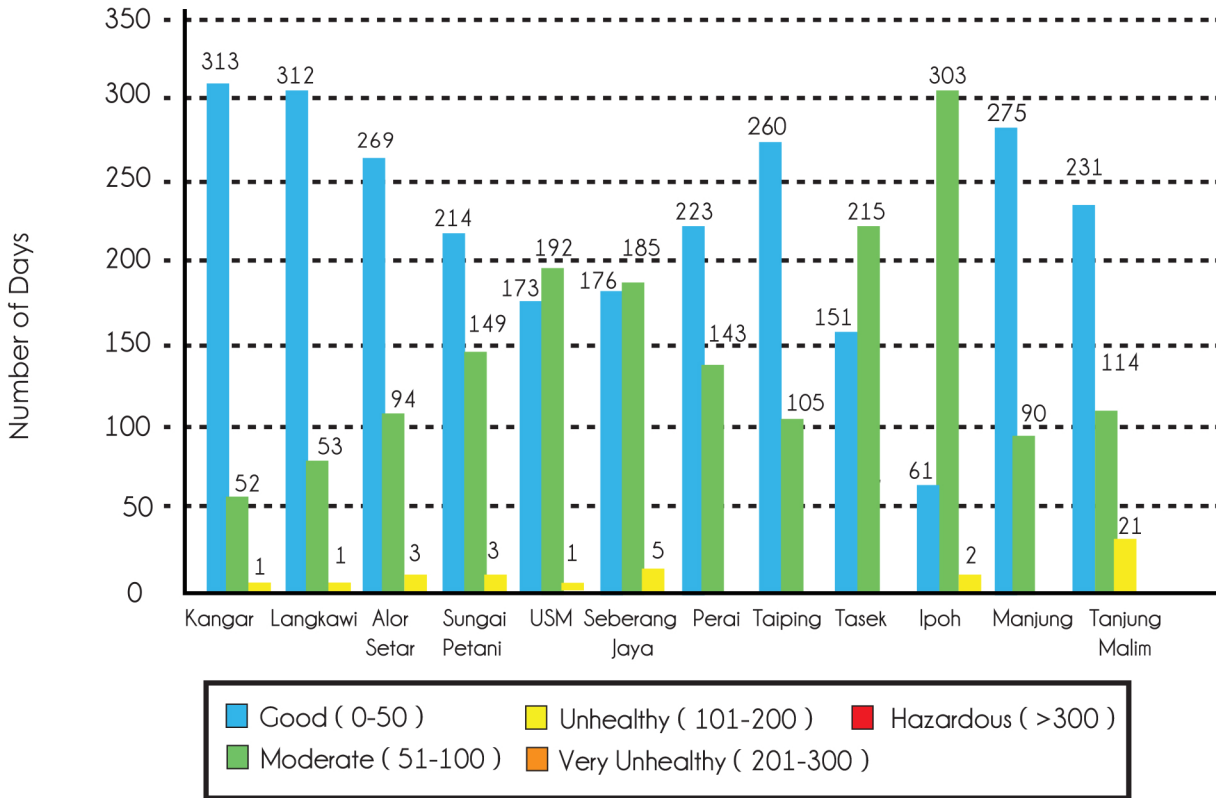
Figure 1.2 Malaysia : Klang Valley Air Quality Status,2012

NORTHERN REGION

The overall air quality of the northern region of the West Coast of Peninsular Malaysia covering Perlis, Kedah, Pulau Pinang and Perak, was between good to moderate most of the time. However, Tanjung Malim recorded 21 unhealthy days, Seberang Jaya recorded five (5) unhealthy days, Alor Setar recorded three (3) unhealthy days, Sungai Petani recorded three (3) unhealthy days, Ipoh recorded two (2) unhealthy days and one (1) unhealthy day were recorded at Kangar, Langkawi and USM. The pollutants concerned were O_3 and PM_{10} . **Figure 1.3** shows the overall air quality status for the northern region of the West Coast of Peninsular Malaysia.

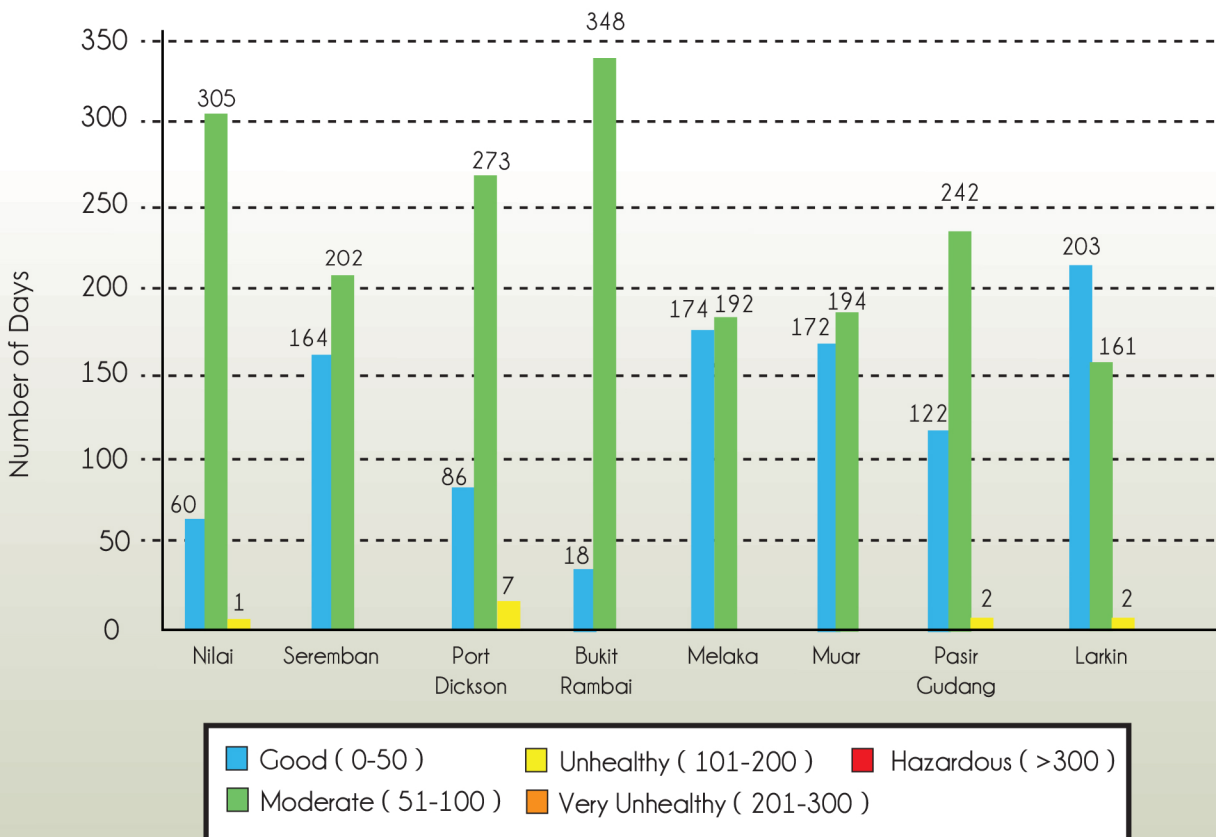
SOUTHERN REGION

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 (7 days), Pasir Gudang (2 days), Larkin (2 days) and Nilai (1 day). There was a slight increase in the number of unhealthy days in this region compared to 2011. **Figure 1.4** shows the overall air quality status for the southern region of the West Coast of Peninsular Malaysia.



Note: Reading based on daily Maximum API

Figure 1.3 Malaysia : Air Quality Status, Northern Region of The West Coast of Peninsular Malaysia, 2012



Note: Reading based on daily Maximum API

Figure 1.4 Malaysia : Air Quality Status, Southern Region of The West Coast of Peninsular Malaysia, 2012

AIR QUALITY STATUS IN THE EAST COAST

In the East Coast of Peninsular Malaysia (Pahang, Terengganu, Kelantan and East Johor) the air quality remained between good to moderate most of the time. Only Kota Tinggi in Johor recorded one (1) unhealthy day due to high level of O_3 . The overall air quality status in the East Coast of Peninsular Malaysia is shown in **Figure 1.5**.

AIR QUALITY STATUS IN SABAH, LABUAN AND SARAWAK

The air quality in Sabah, Labuan and Sarawak was generally good. However there was a short spell of local haze episode at ILP Miri that recorded one (1) hazardous day in June 2012. The overall air quality status in Sarawak is shown in **Figure 1.6** and **Figure 1.7** shows the overall air quality in Sabah and Labuan.

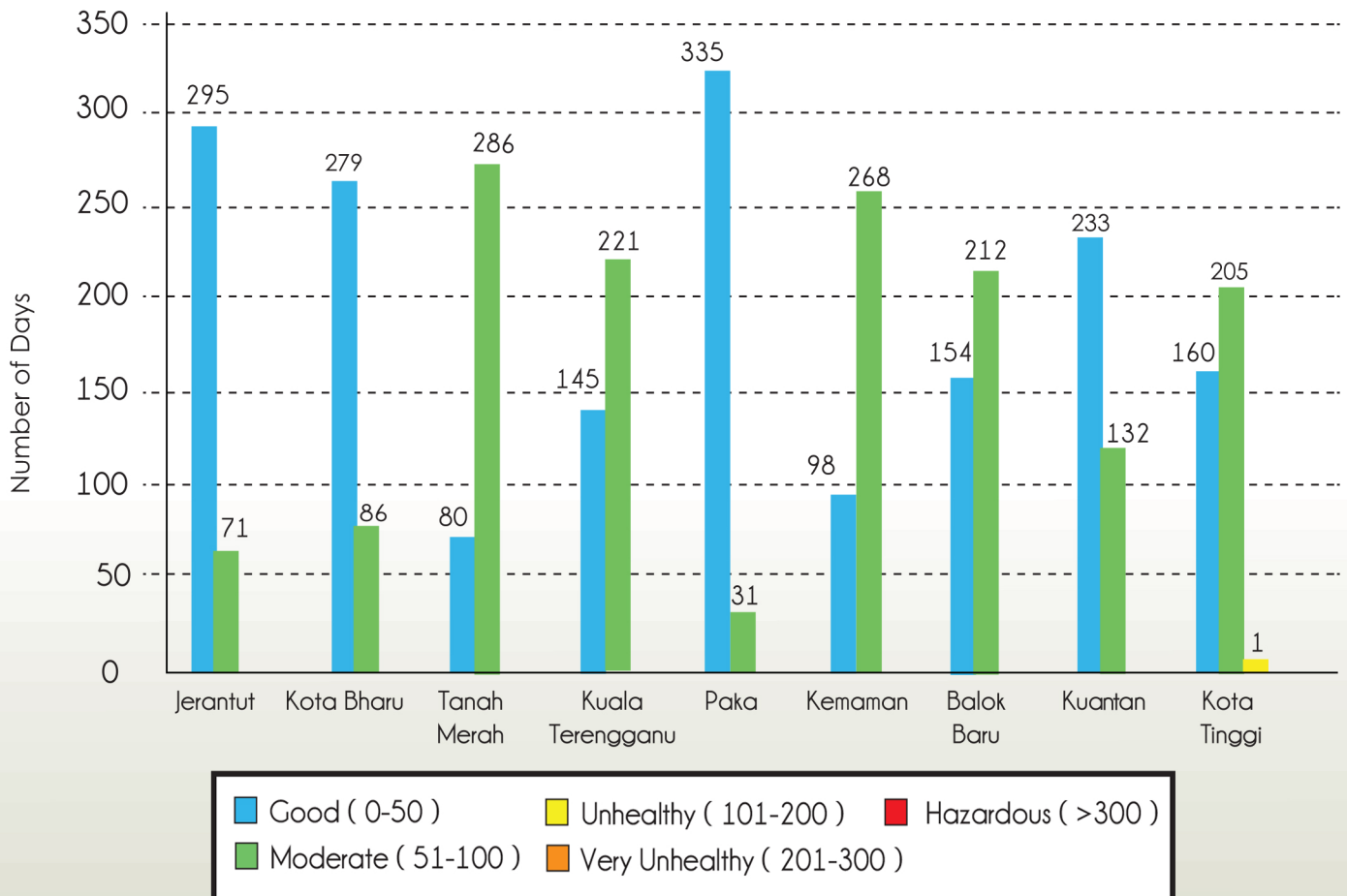
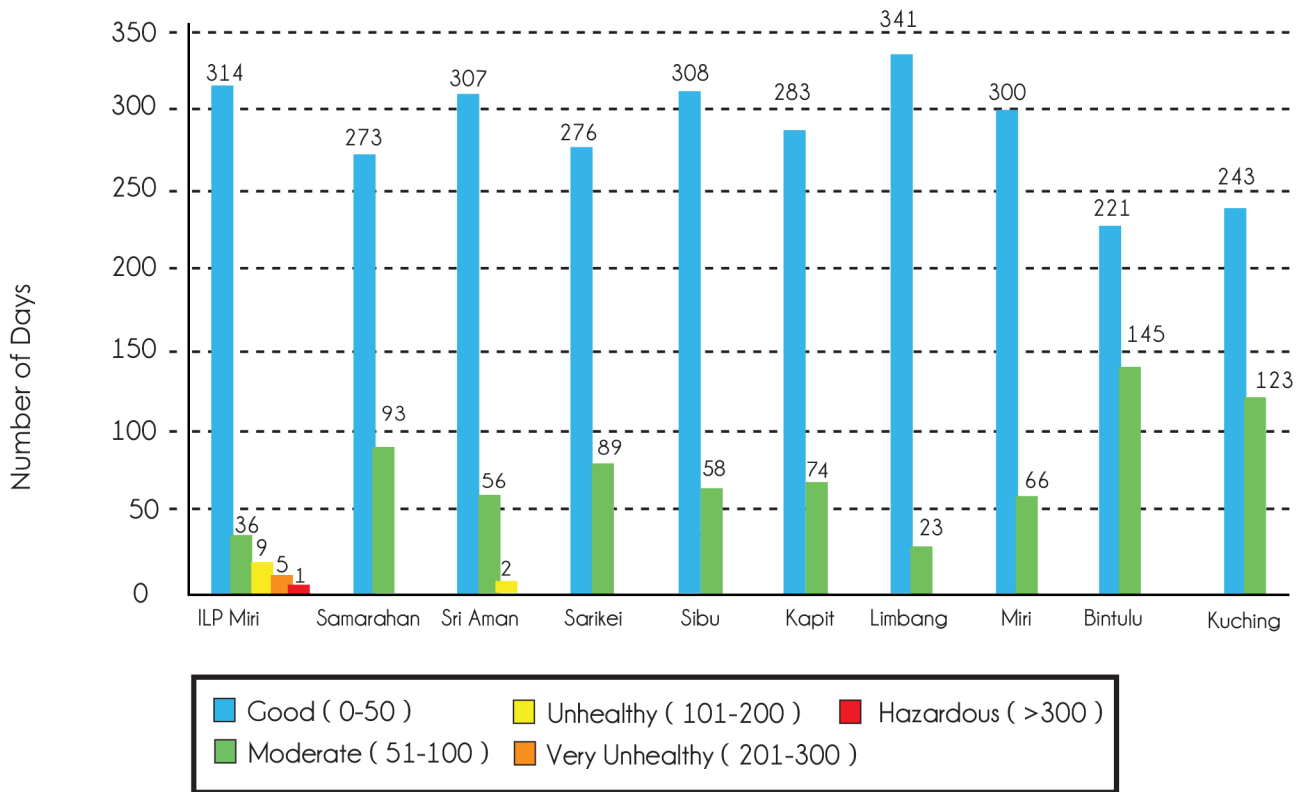
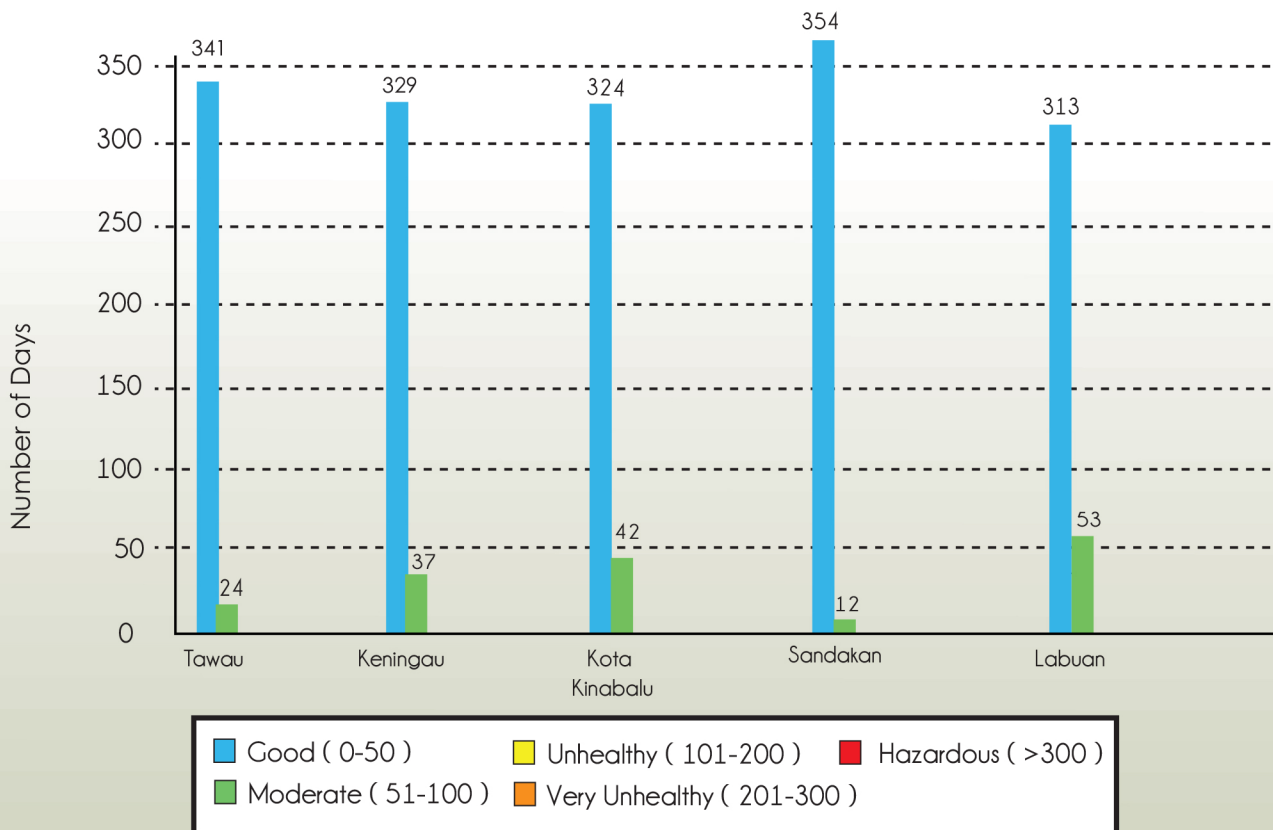


Figure 1.5 Malaysia : Air Quality Status, East Coast Peninsular Malaysia, 2012



Note: Reading based on daily Maximum API

Figure 1.6 Malaysia : Air Quality Status, Sarawak, 2012



Note: Reading based on daily Maximum API

Figure 1.7 Malaysia : Air Quality Status, Sabah And Labuan, 2012

AIR QUALITY TREND

Five (5) air pollutants, namely particulate matter (PM₁₀), ozone (O₃), sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and carbon monoxide (CO) were monitored continuously at 52 locations. The air quality trend for the period of 1999 to 2012 was computed by averaging direct measurement from the monitoring sites on a yearly basis and cross-reference with Malaysia Ambient Air Quality Guidelines as shown in **Table 1.2**.

PARTICULATE MATTER (PM₁₀)

In 2012, the annual average value of PM₁₀ in the ambient air was 43 µg/m³ which is below the Malaysian Ambient Air Quality Guidelines value of 50 µg/m³. This value remained as in 2011. Transboundary smoke haze and local peat fire had contributed to the higher PM₁₀ recorded intermittently in several areas in Klang Valley and in ILP Miri respectively.

The trend of the annual average levels of PM₁₀ concentration in the ambient air between 1999 and 2012 complied to the Malaysian Ambient Air Quality Guidelines as shown in **Figure 1.8**. Based on land use categories, PM₁₀ concentration was in compliance with Malaysian Ambient Air Quality Guidelines as shown in **Figure 1.8(a)**.

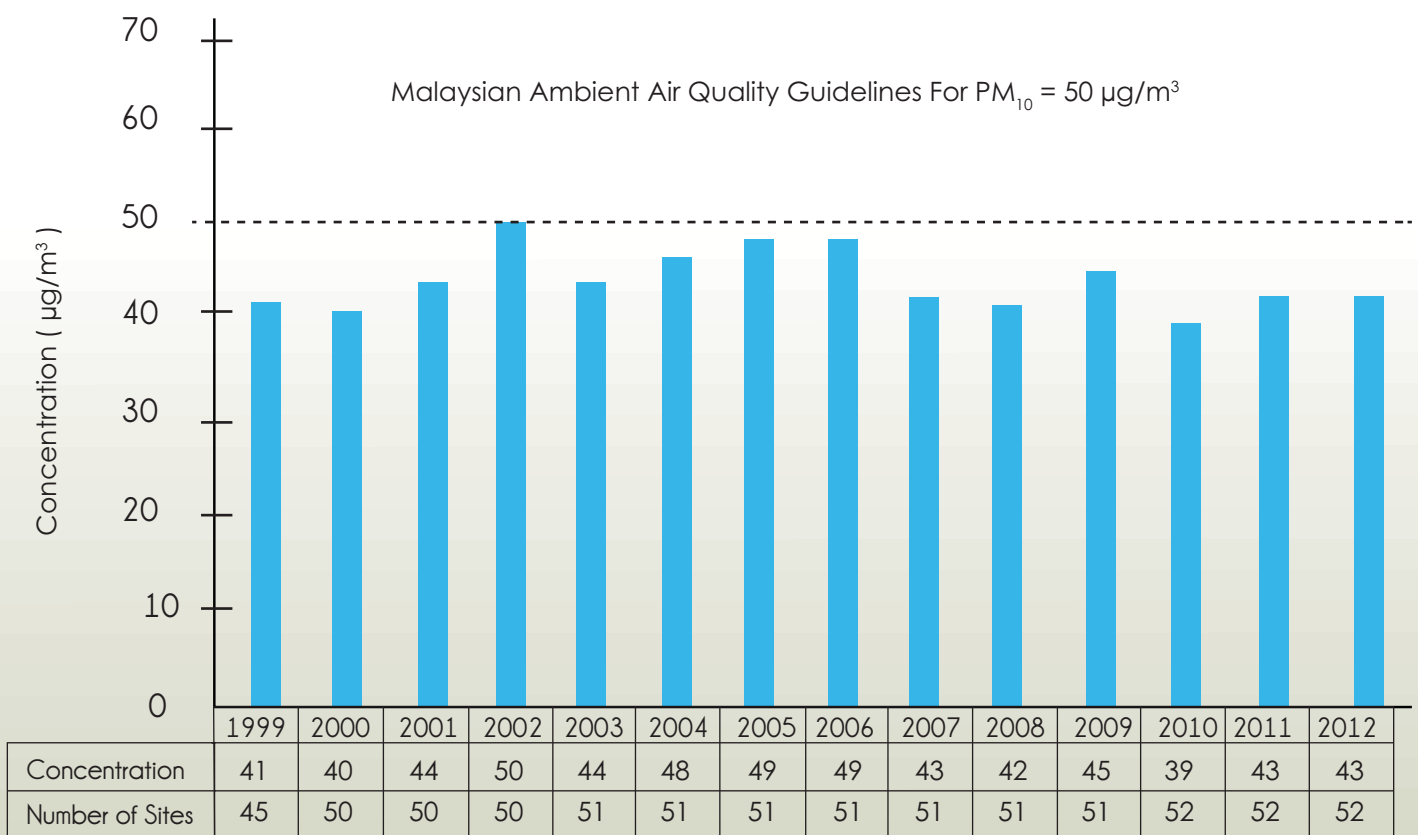


Figure 1.8 Malaysia : Annual Average Concentration of Particulate Matter (PM₁₀), 1999 - 2012

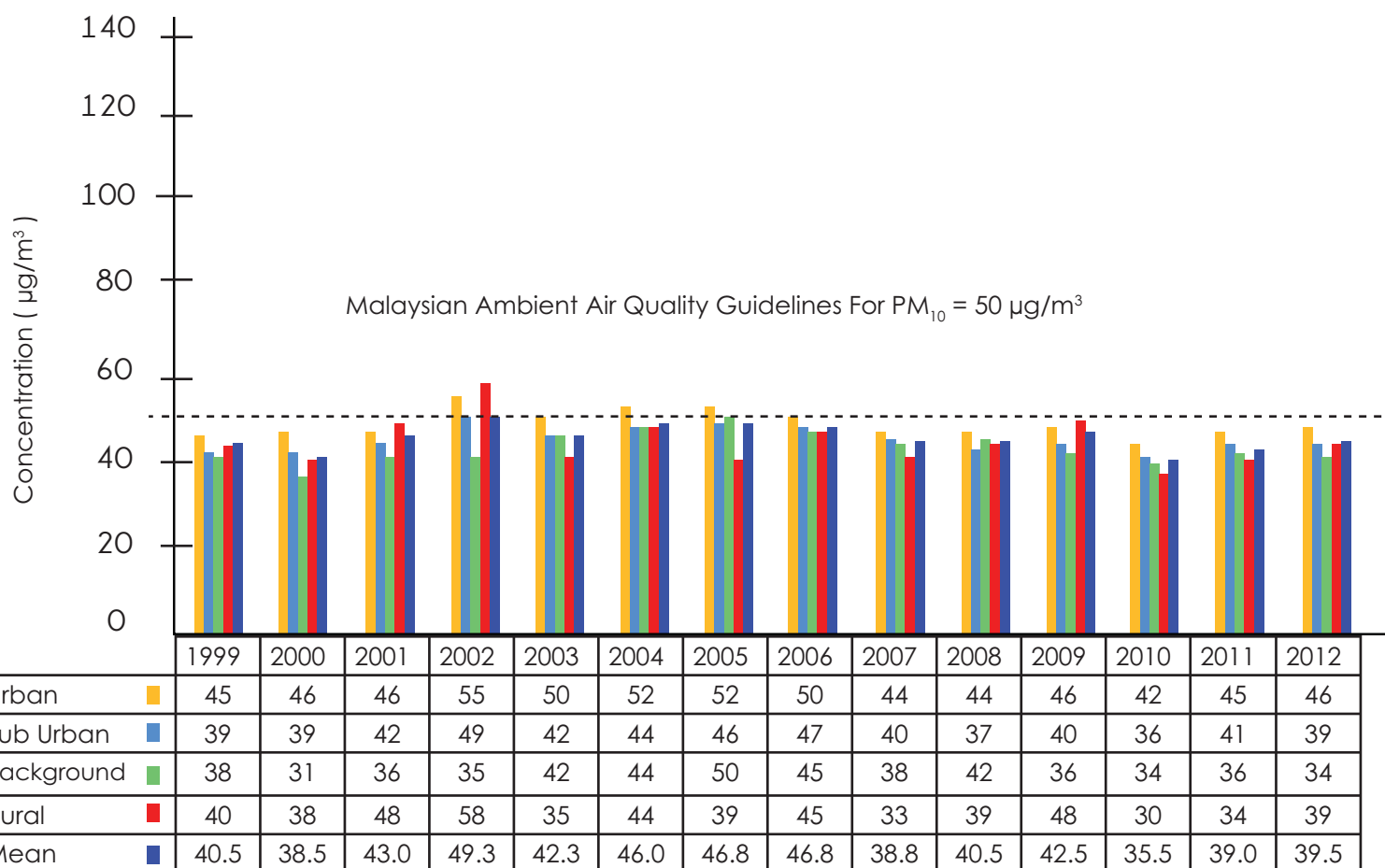


Figure 1.8 (a) Malaysia :
Annual Average Concentration of Particulate Matter (PM₁₀) by Land Use, 1999 - 2012

GROUND LEVEL OZONE (O₃)

In 2012, the annual average daily maximum one-hour ozone concentrations slightly increased by 0.2 percent compared to 2011. However, the annual average daily maximum one-hour ozone concentrations in ambient air for 1999 to 2012 were well below the limit of 0.1 ppm as stipulated in the Malaysian Ambient Quality Guidelines and the trend are as shown in **Figure 1.9**.

Figure 1.9(a) shows the ozone concentration for various land use categories between 1999 and 2012. Urban areas recorded higher levels of ozone due to higher traffic volume and a conducive atmospheric condition resulting in its formation. The rural and sub urban areas had also being impacted as a result from down wind effect transporting ozone pollution from the sources of ozone precursors namely nitrogen oxides (NO_x) and volatile organic compound (VOC) mainly due to emission from motor vehicles and industries.

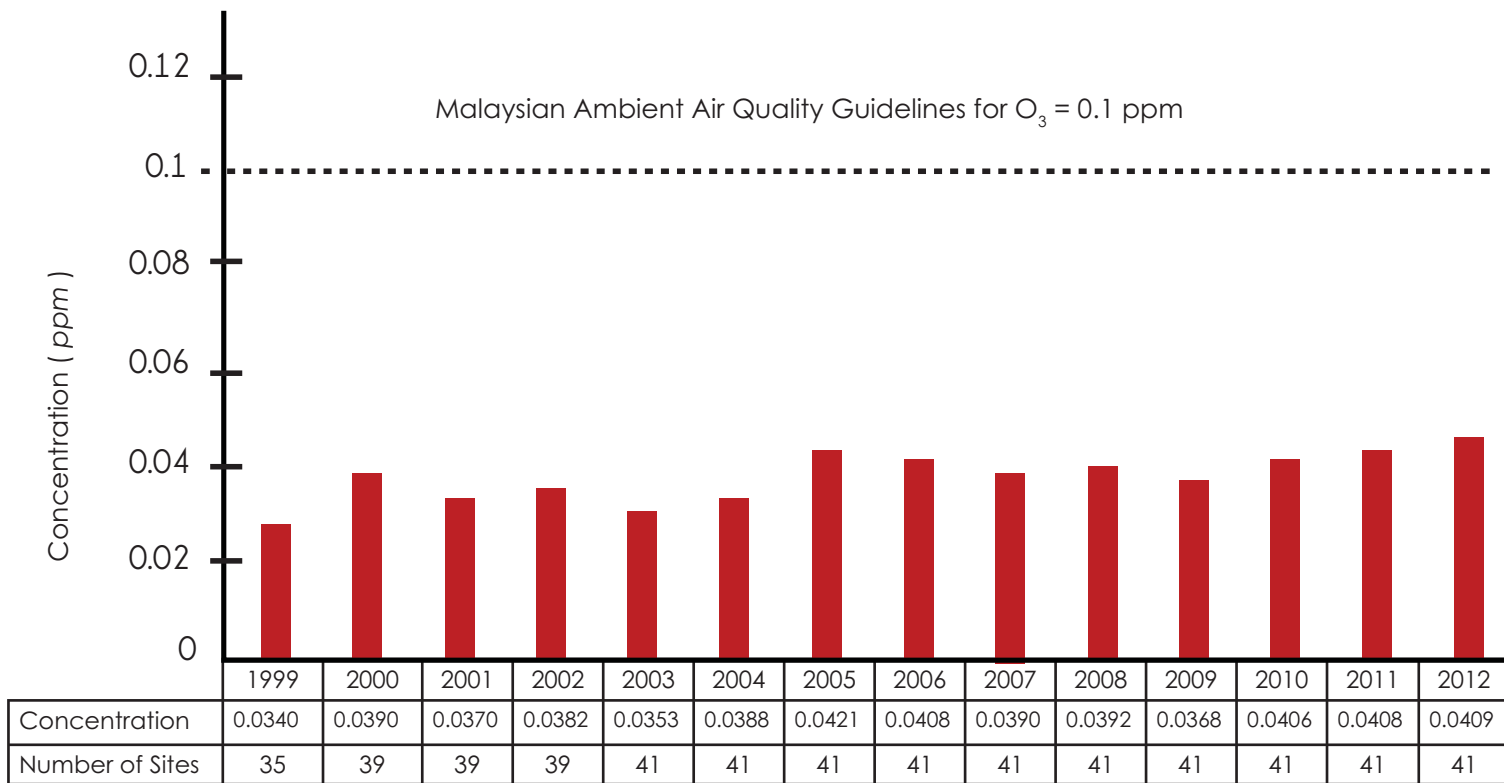


Figure 1.9 Malaysia :
Annual Average Concentration of Ozone (O_3), 1999 - 2012

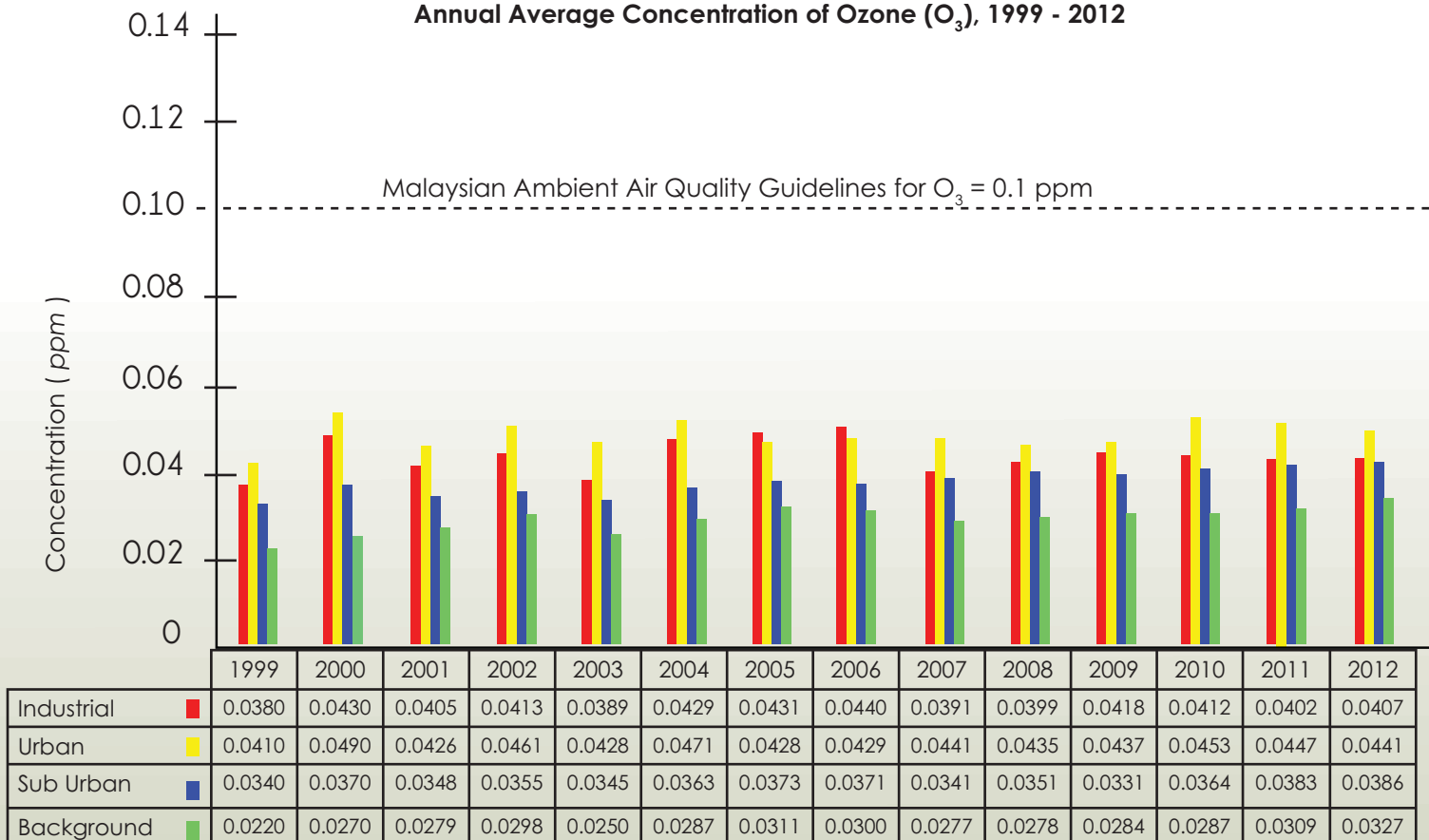


Figure 1.9 (a) Malaysia :
Annual Average Daily Maximum 1 Hour Concentration of Ozone (O_3) by Land Use, 1999 - 2012

SULPHUR DIOXIDE (SO₂)

Generally, the annual average SO₂ concentration shows a declining trend between 1999 and 2012 (**Figure 1.10**) and it is well below the limit of 0.04 ppm as stipulated in the Malaysian Ambient Air Quality Guidelines.

This was attributed by the use of better fuel quality EURO-2M in this country starting from September 2009 and also stricter enforcement by the DOE as well as widely use of natural gas for industrial combustion process and vehicles. **Figure 1.10(a)** shows the annual average concentrations of sulphur dioxide from different categories of land use.

NITROGEN DIOXIDE (NO₂)

In 2012, there was no significant change of NO₂ concentration compared to the 2011 level. The NO₂ 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 NO₂ emission load indicates 60 percent was from power plants while 26 percent from motor vehicles, six (6) percent from industries and eight (8) percent from other sources.

The annual average concentration of NO₂ in the ambient air from 1999 to 2012 remained almost constant and well below the Malaysia Ambient Air Quality Guidelines. (**Figure 1.11** and **Figure 1.11(a)**).

CARBON MONOXIDE (CO)

There was a slight deterioration in the air quality where CO level had increased by 0.3 percent in 2012 compared to 2011. However the trend of CO concentration from 1999 to 2012 remains almost constant. The levels recorded were in compliance to the Malaysian Ambient Air Quality Guidelines (**Figure 1.12**). 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 2012. **Figure 1.12(a)** shows CO concentrations for various categories of land use.



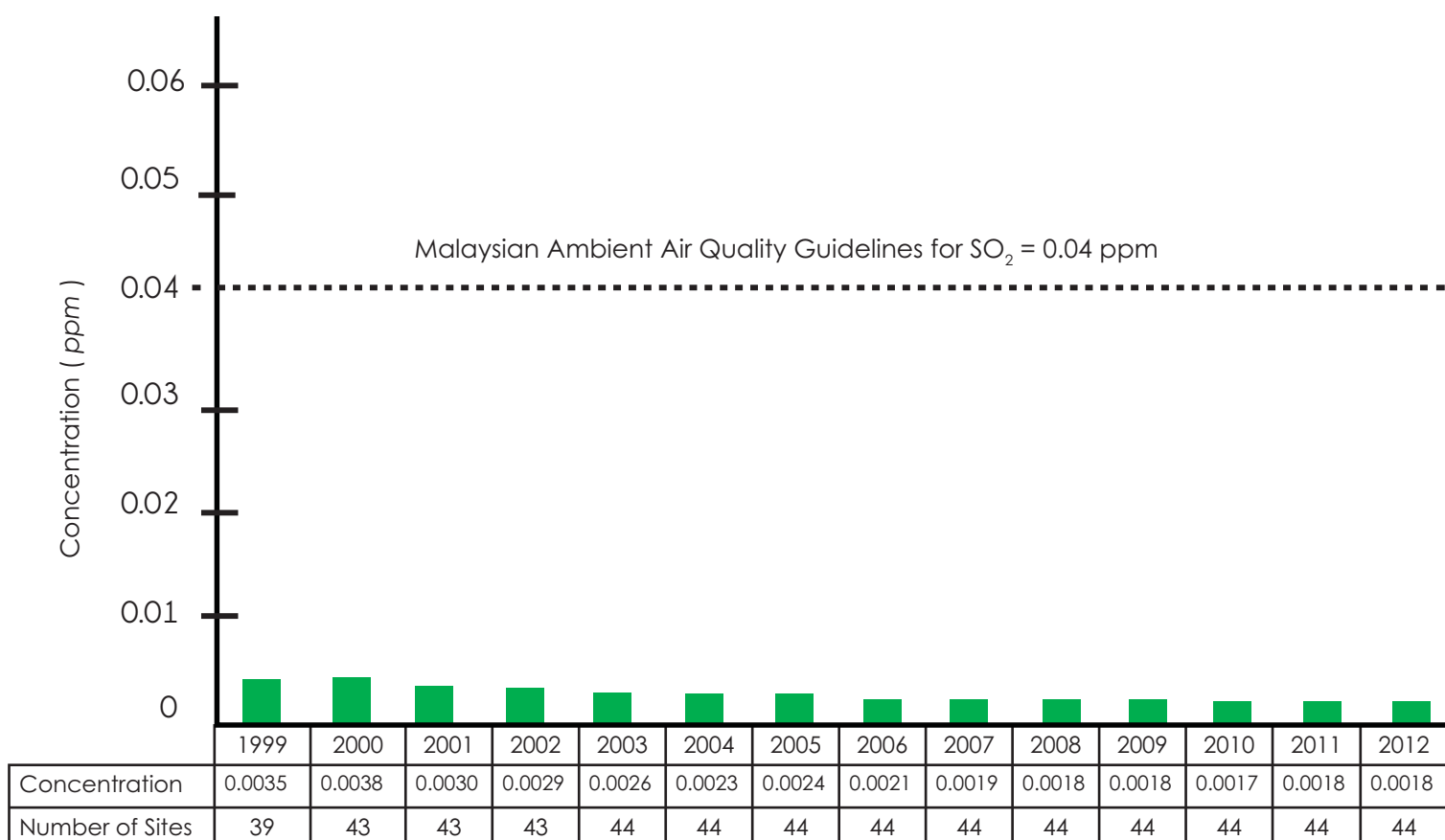


Figure 1.10 Malaysia :
Annual Average Concentration of Sulphur Dioxide (SO₂), 1999 - 2012

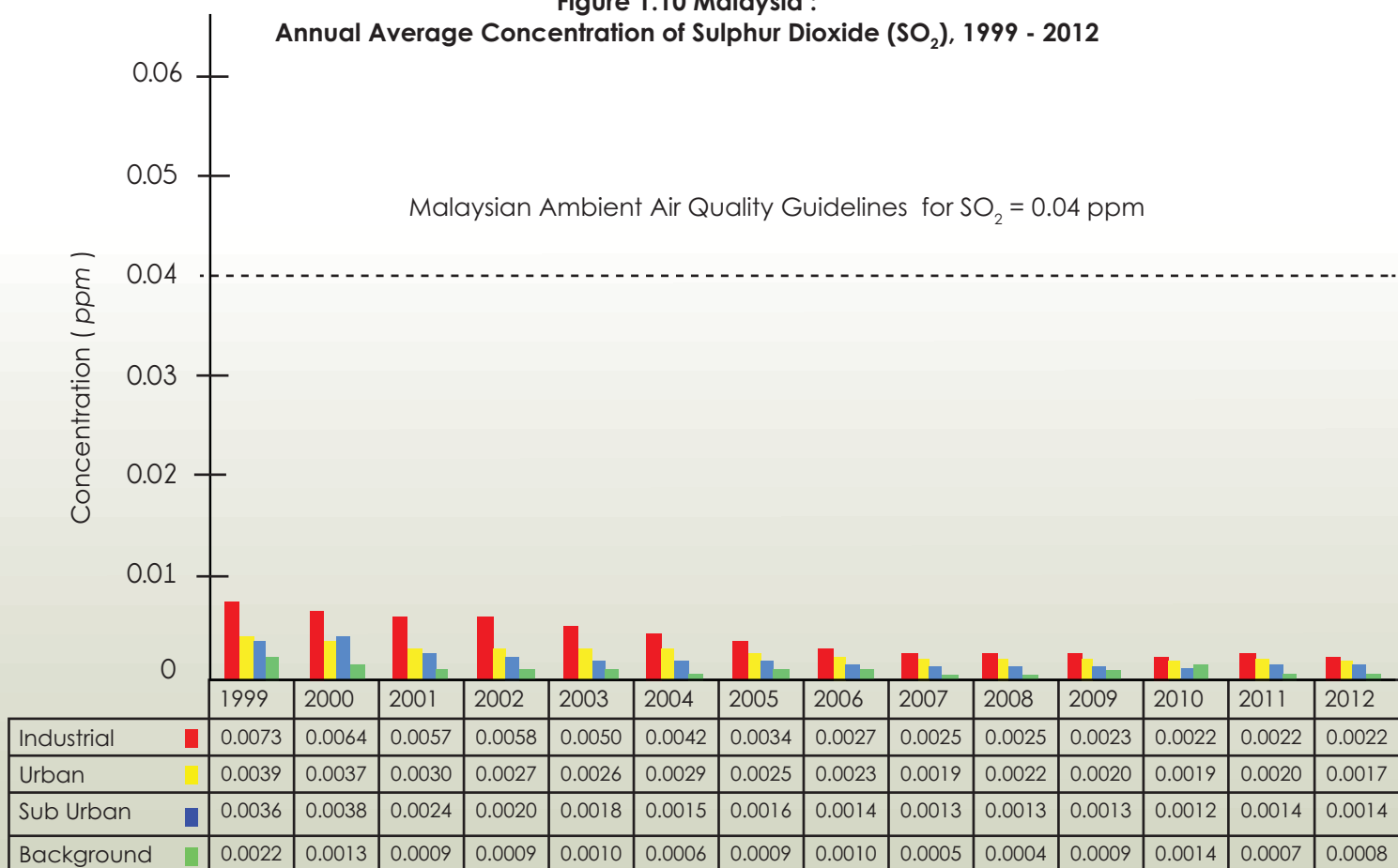


Figure 1.10 (a) Malaysia :
Annual Average Concentration of Sulphur Dioxide (SO₂) by Land Use, 1990 - 2012

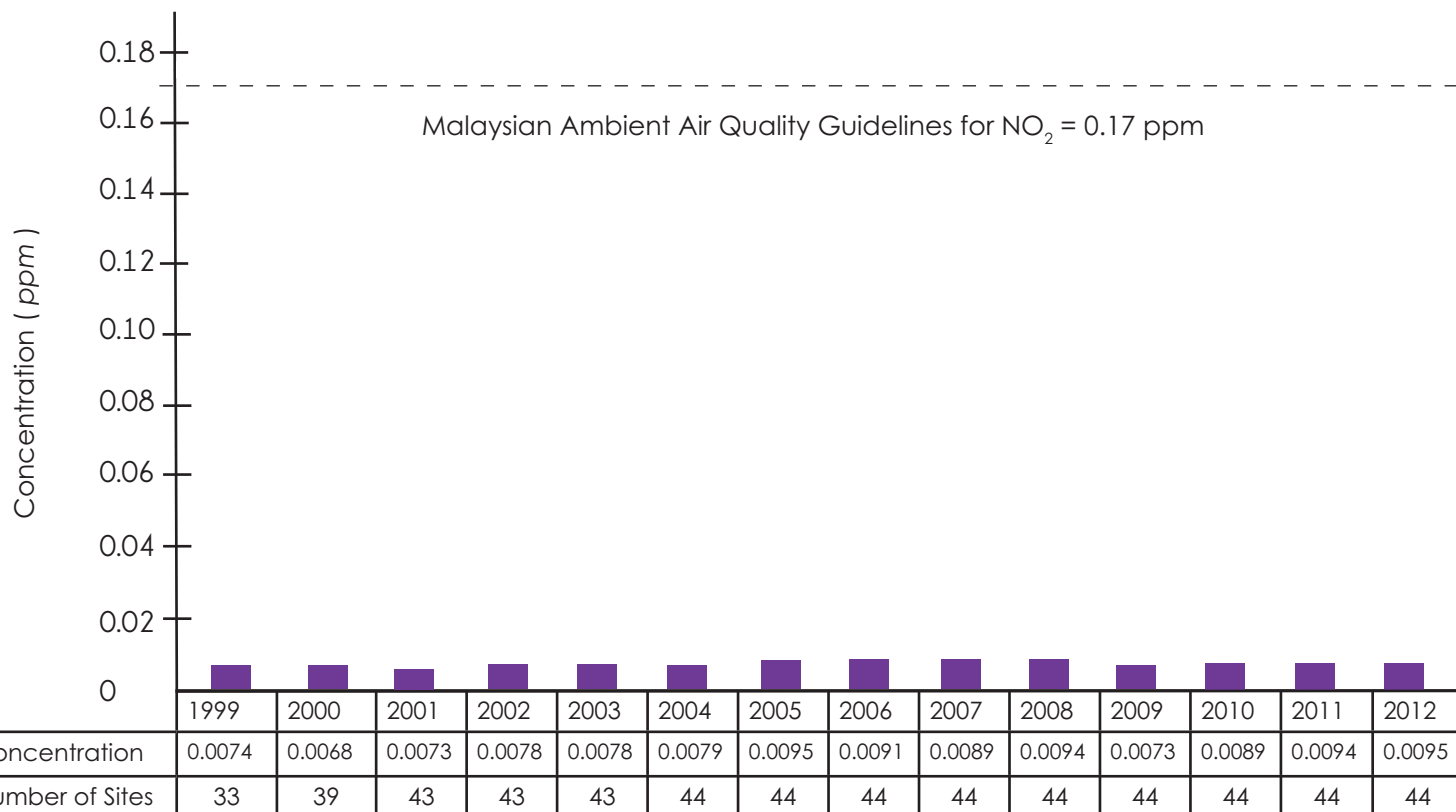


Figure 1.11 Malaysia :
Annual Average Concentration of Nitrogen Dioxide (NO₂), 1999 - 2012

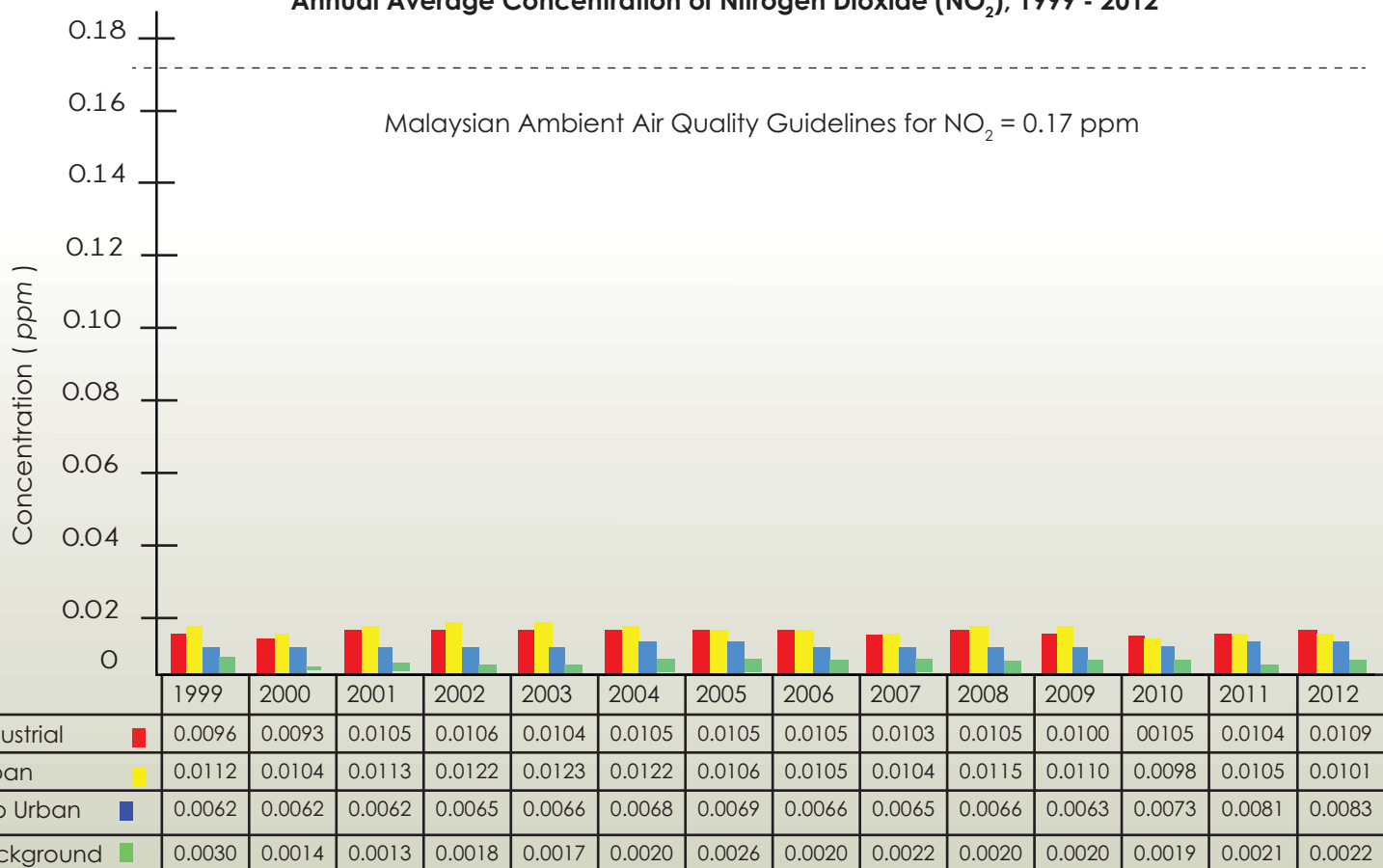


Figure 1.11 (a) Malaysia :
Annual Average Concentration of Nitrogen Dioxide (NO₂) by Land Use, 1999 - 2012

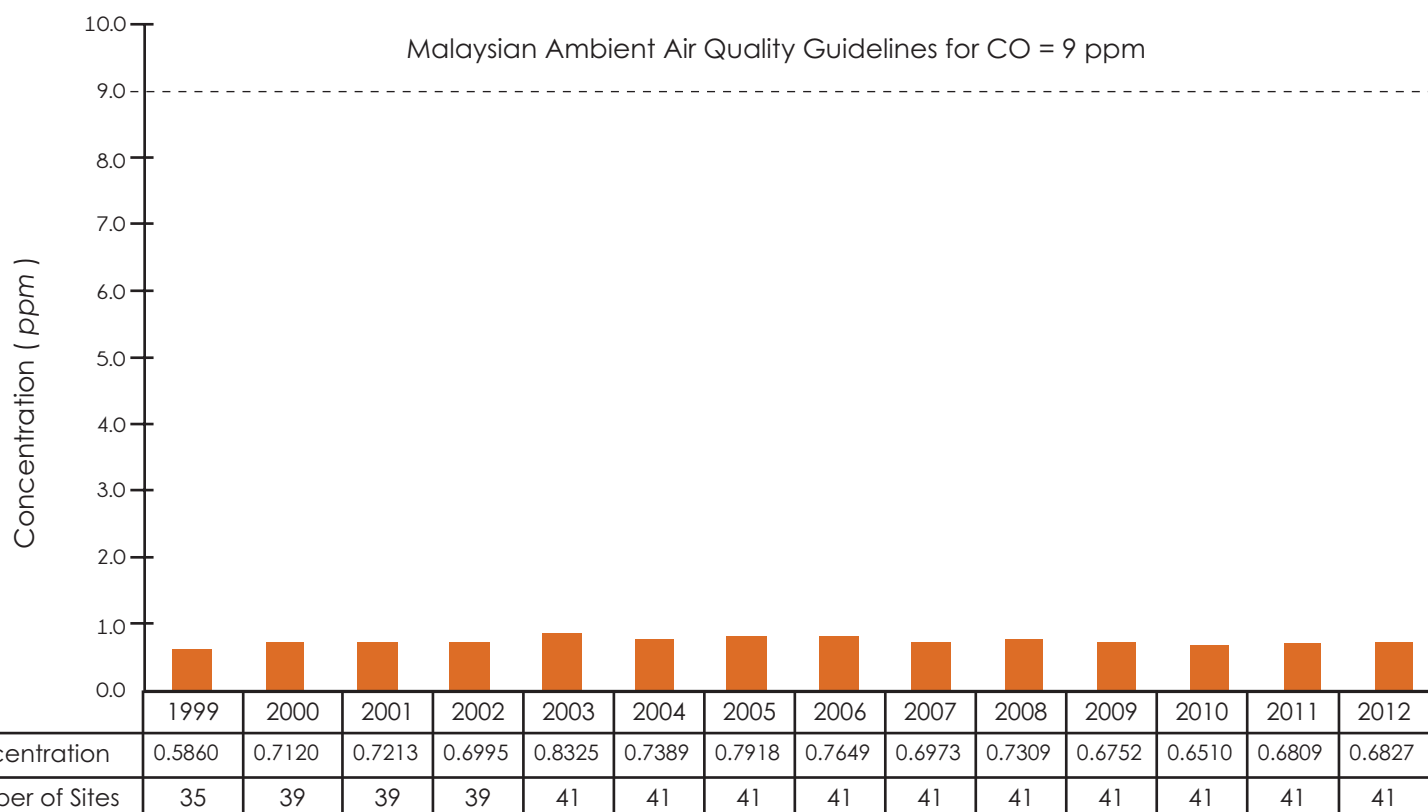


Figure 1.12 Malaysia :
Annual Average Concentration of Carbon Monoxide (CO) , 1999 - 2012

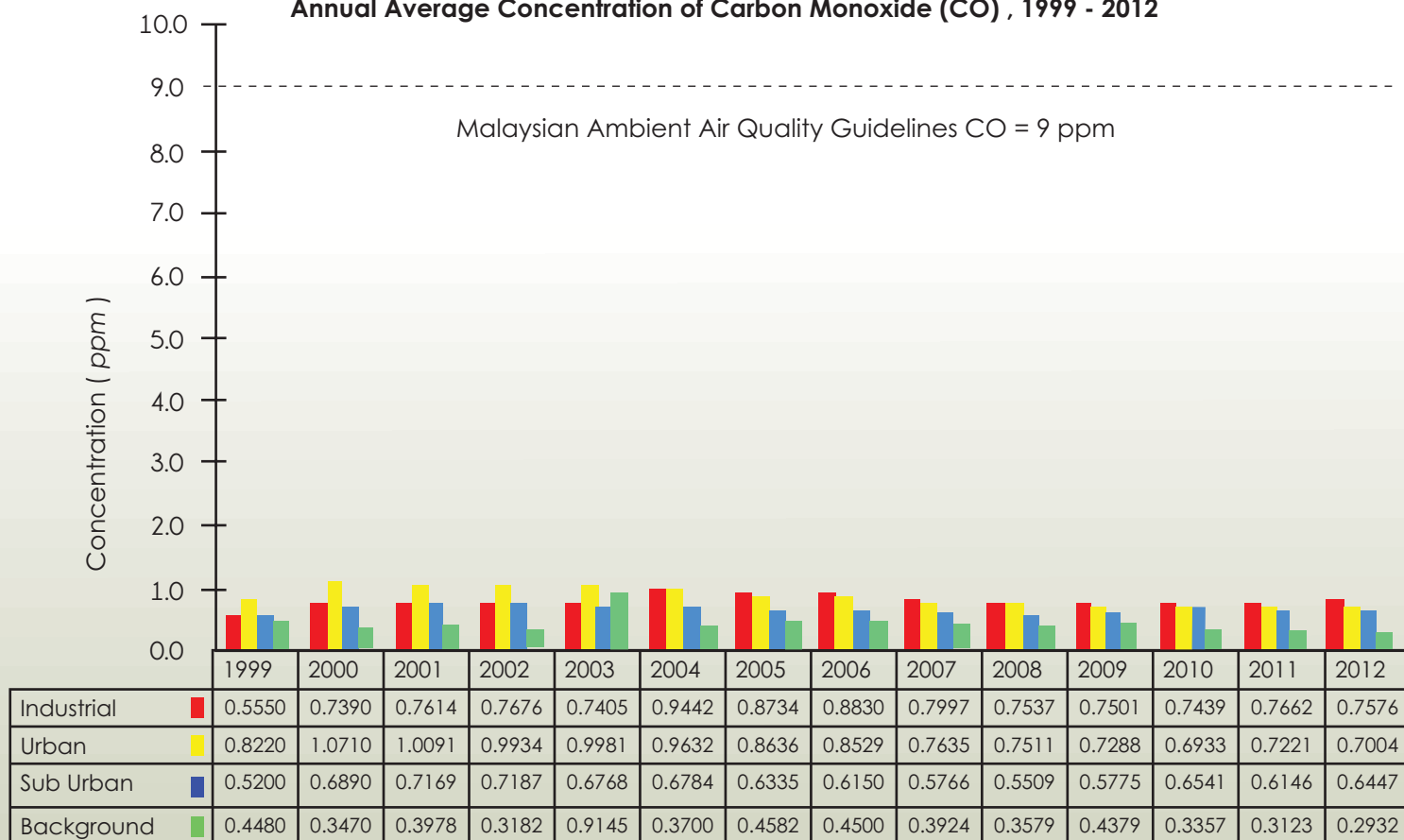


Figure 1.12 (a) Malaysia :
Annual Average Concentration of Carbon Monoxide (CO) , 1999 - 2012



CHAPTER 2



RIVER WATER QUALITY

RIVER WATER QUALITY MONITORING

The Department of Environment (DOE) continued with the river water quality monitoring programme in 2012 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) is used to indicate the level of pollution and the corresponding suitability in terms of uses according to the National Water Quality Standards for Malaysia (NWQS) (**ANNEX**). The WQI takes into consideration parameters including Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammoniacal Nitrogen ($\text{NH}_3\text{-N}$), Suspended Solids (SS) and pH.

In 2012, nine (9) rivers within the Klang River Basin under River of Life Project were added to the national river water quality monitoring programme, making the total numbers of rivers monitored to be 473. The river water quality was assessed based on a total of 5,083 samples taken from 473 rivers, at 832 manual stations (MWQM) and 10 continuous water quality monitoring stations (CWQM) for the purpose of early detection of pollution influx.

RIVER WATER QUALITY STATUS

Out of 473 rivers monitored, 278 (59%) were found to be clean, 161 (34%) slightly polluted and 34 (7%) polluted (**Figure 2.1**). The monitored rivers and their quality status are as in Tables 2.1, 2.2 and 2.3.

As in previous years, the major pollutants detected were Biochemical Oxygen Demand (BOD), Ammoniacal Nitrogen ($\text{NH}_3\text{-N}$) and Suspended Solids (SS). High BOD can be attributed to inadequate treatment of sewage or effluent from agro-based and manufacturing industries. The main sources of $\text{NH}_3\text{-N}$ were livestock farming and domestic sewage. While the sources for SS were mainly due to improper earthworks and land clearing activities.

Table 2.4 shows that out of 34 polluted rivers, generally 19 rivers were classified as Class III, 14 rivers as Class IV and one (1) river as Class V.

In terms of BOD, 17 rivers were classified as Class IV and 17 rivers as Class V. In terms of $\text{NH}_3\text{-N}$, four (4) rivers were classified as Class IIB, 12 rivers as Class IV and 18 rivers as Class V.

In terms of SS, eight (8) rivers were classified as Class I, 16 rivers as Class IIB, 8 rivers as Class III, and one (1) river each as Class IV and Class V.

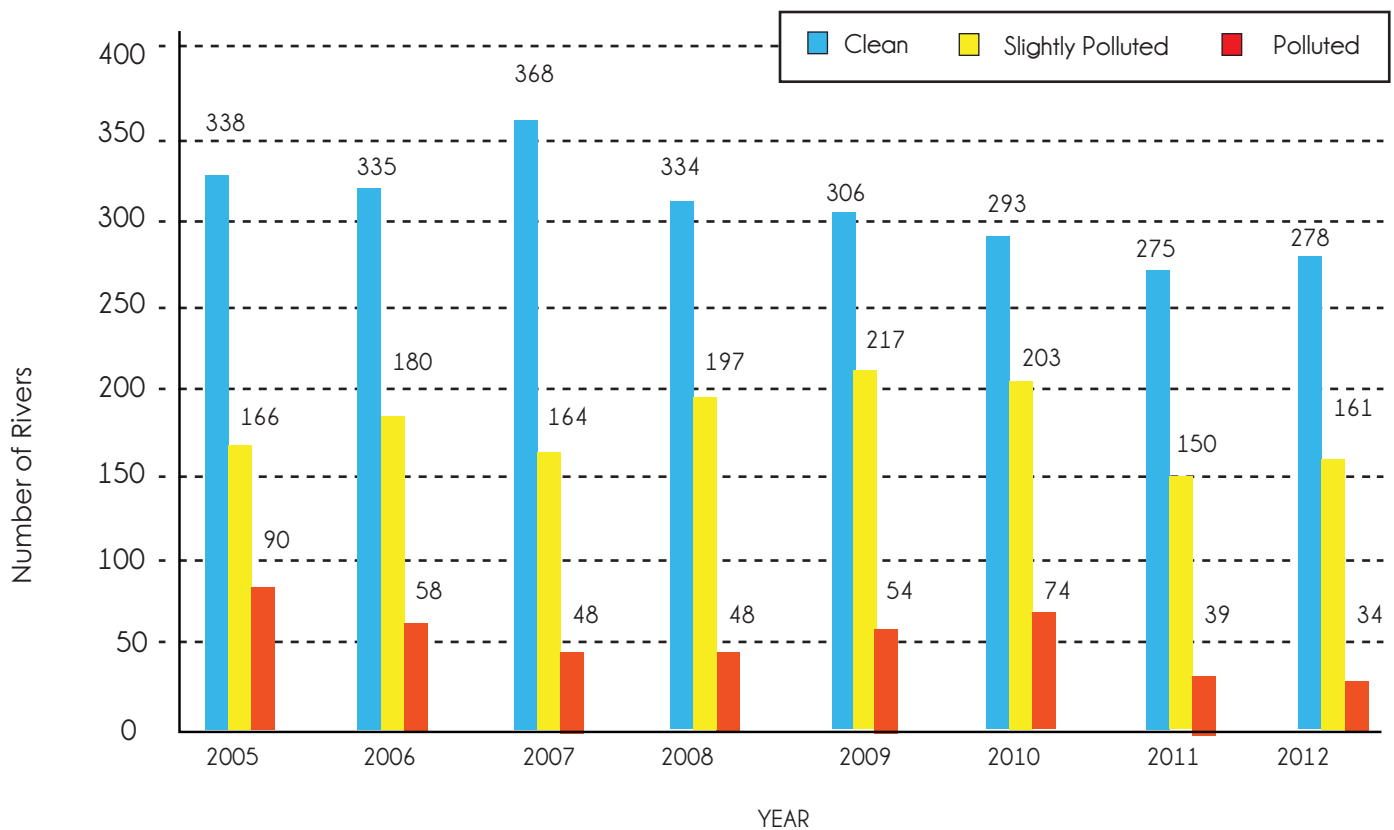


Figure 2.1 Malaysia : River Water Quality Trend (2005 - 2012)

CONTINUOUS WATER QUALITY MONITORING

The dissolved oxygen is an indicator of BOD strength exerted by organic pollutants. In terms of dissolved oxygen level, 82% of the data recorded at Sg. Perak were within the range of 5-8 mg/l (Class IIB of the NWQS), followed by Sg. Rajang (72 %), Sg. Melaka (34%), Sg. Selangor (24%), Sg. Labu (23%), Sg. Linggi (22%), Sg. Skudai (16%) and Sg. Sarawak (11%). Meanwhile, only 3% of the data recorded at Sg. Jinjang and Sg. Putat were within the Class IIB (**Figure 2.2**).

The ammonium is an ionized form of ammonia. The measurement of ammonium can indicate the potential to form ammonia or ammoniacal nitrogen pollutants in rivers when pH changes. Almost all of the ammonium levels recorded from Sg. Putat, Sg. Skudai and Sg. Jinjang and over 50% data recorded from Sg. Selangor, Sg. Labu, Sg. Linggi, Sg. Melaka and Sg. Sarawak were found to have exceeded 0.3 mg/l (the Class IIB of the NWQS). Meanwhile, ammonium from Sg. Rajang and Sg. Perak were within the Class IIB limits (**Figure 2.3**).

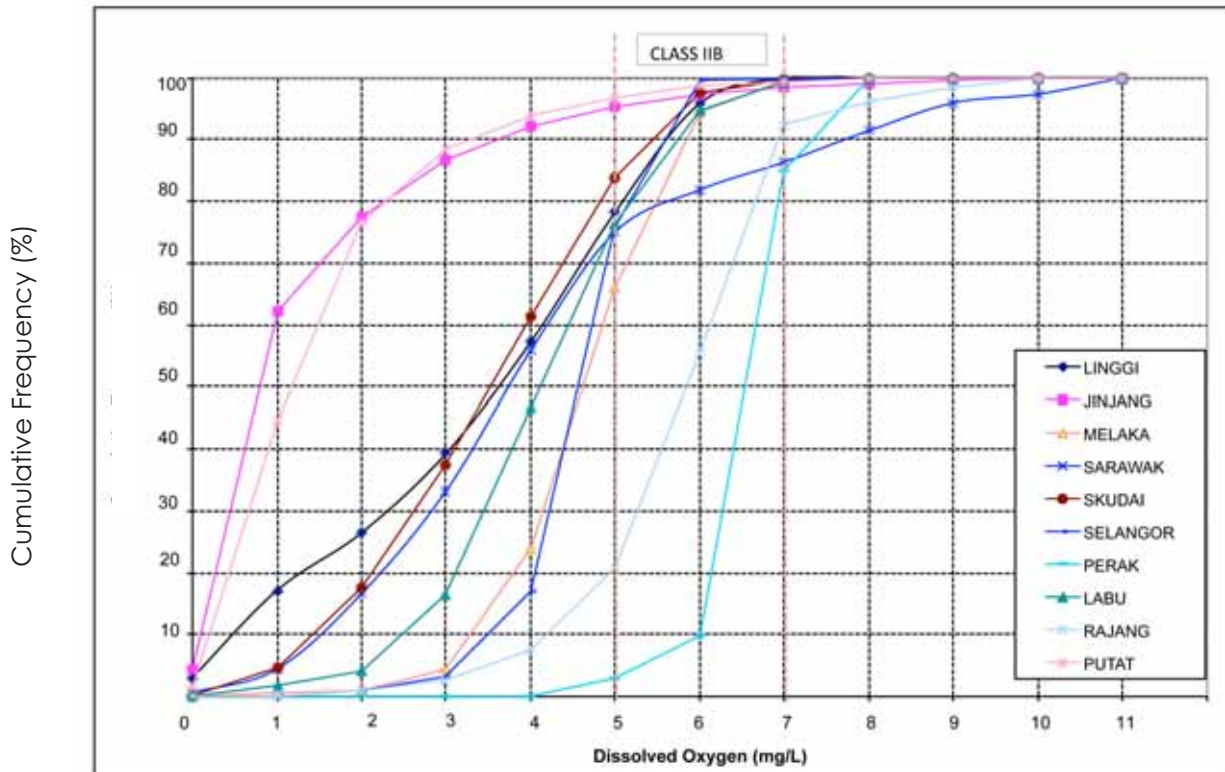


Figure 2.2 Comparison of Cumulative Frequency for 10 CWQM Stations - Dissolved Oxygen : 1st January - 31st December 2012

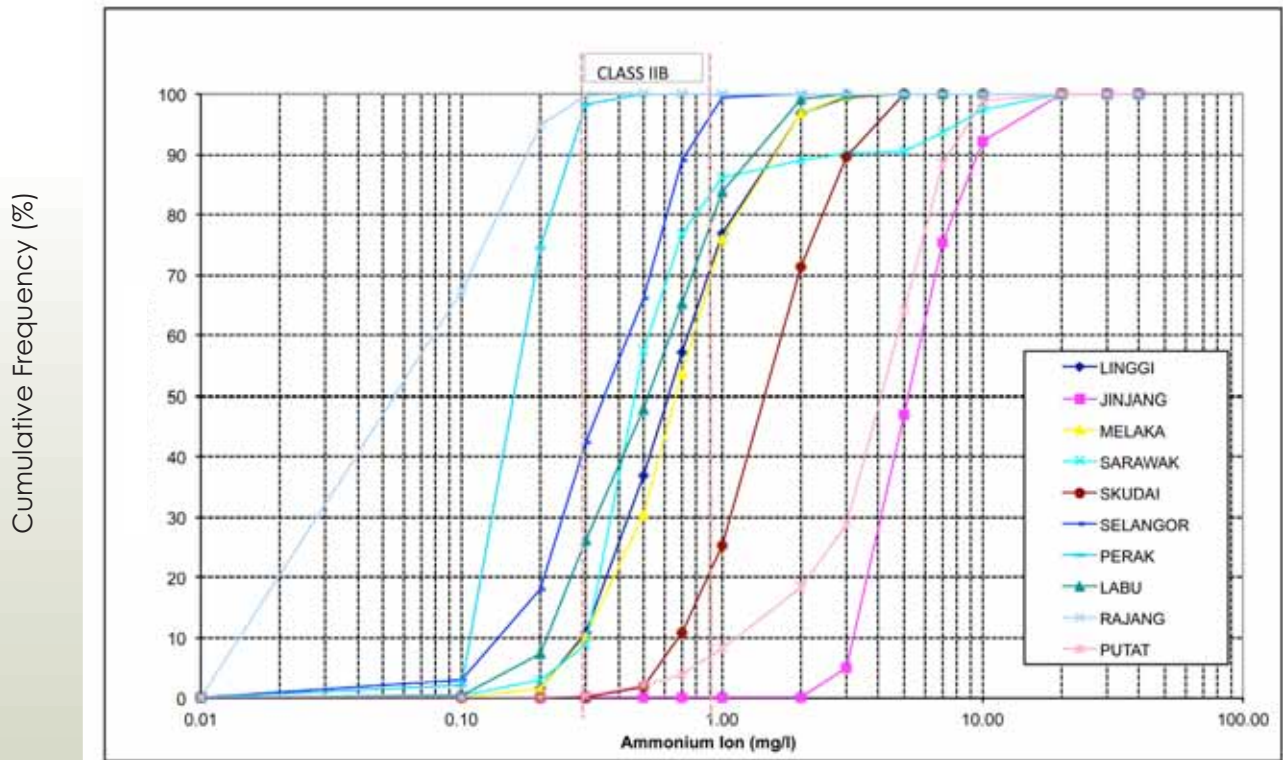


Figure 2.3 Comparison of Cumulative Frequency for 10 CWQM Stations - Ammonium Ion Concentration : 1st January - 31st December 2012

Turbidity is used as an indicator of suspended solids in a river. Data for Sg. Putat showed that 70% of turbidity readings were within 50 NTU (Class IIB standard of NWQS) followed by Sg. Labu (61%), Sg. Perak (51%), Sg. Jinjang (50%), Sg. Skudai (43%), Sg. Selangor (16%) and Sg. Sarawak (12%). Turbidity data for both Sg. Linggi and Sg. Rajang were below 10% (within the 50 NTU), while almost all turbidity data at Sg. Melaka had exceeded the Class IIB standard (Figure 2.4).

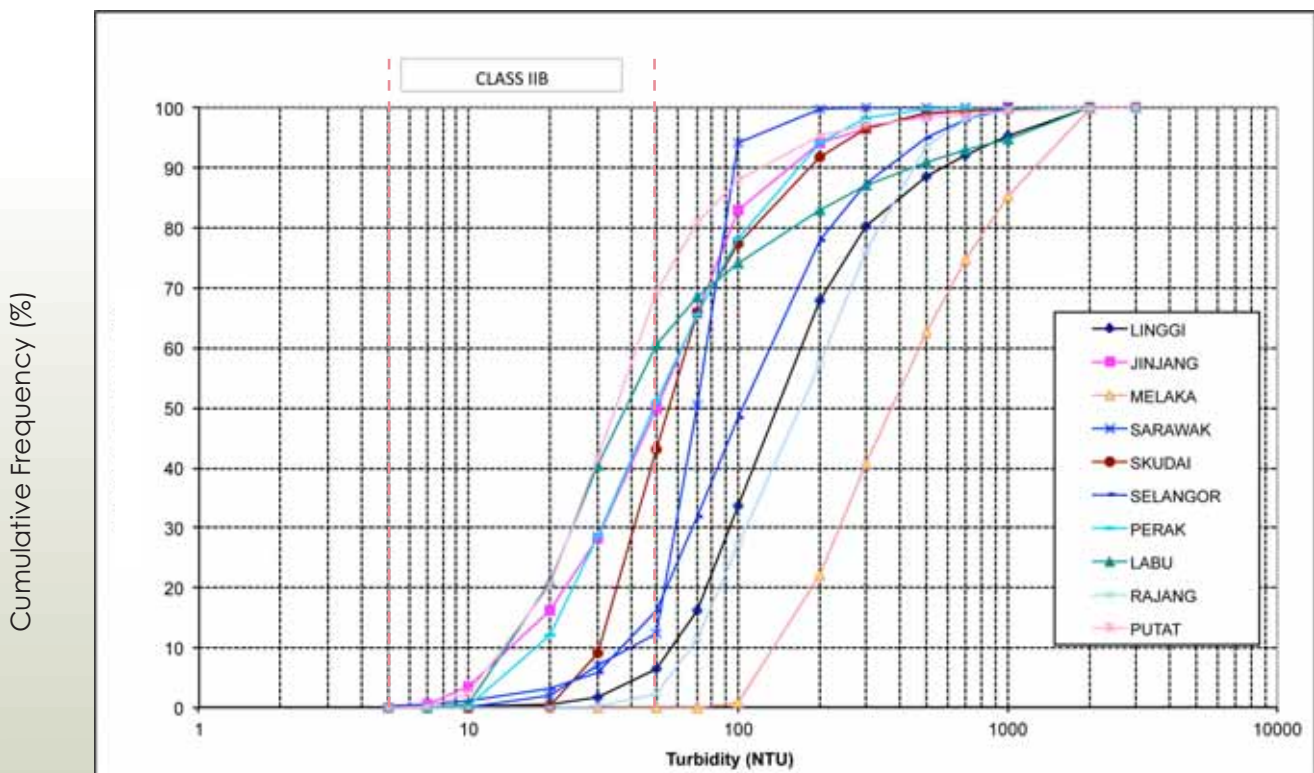


Figure 2.4. Comparison of Cumulative Frequency for 10 CWQM Stations - Turbidity : 1st January - 31st December 2012

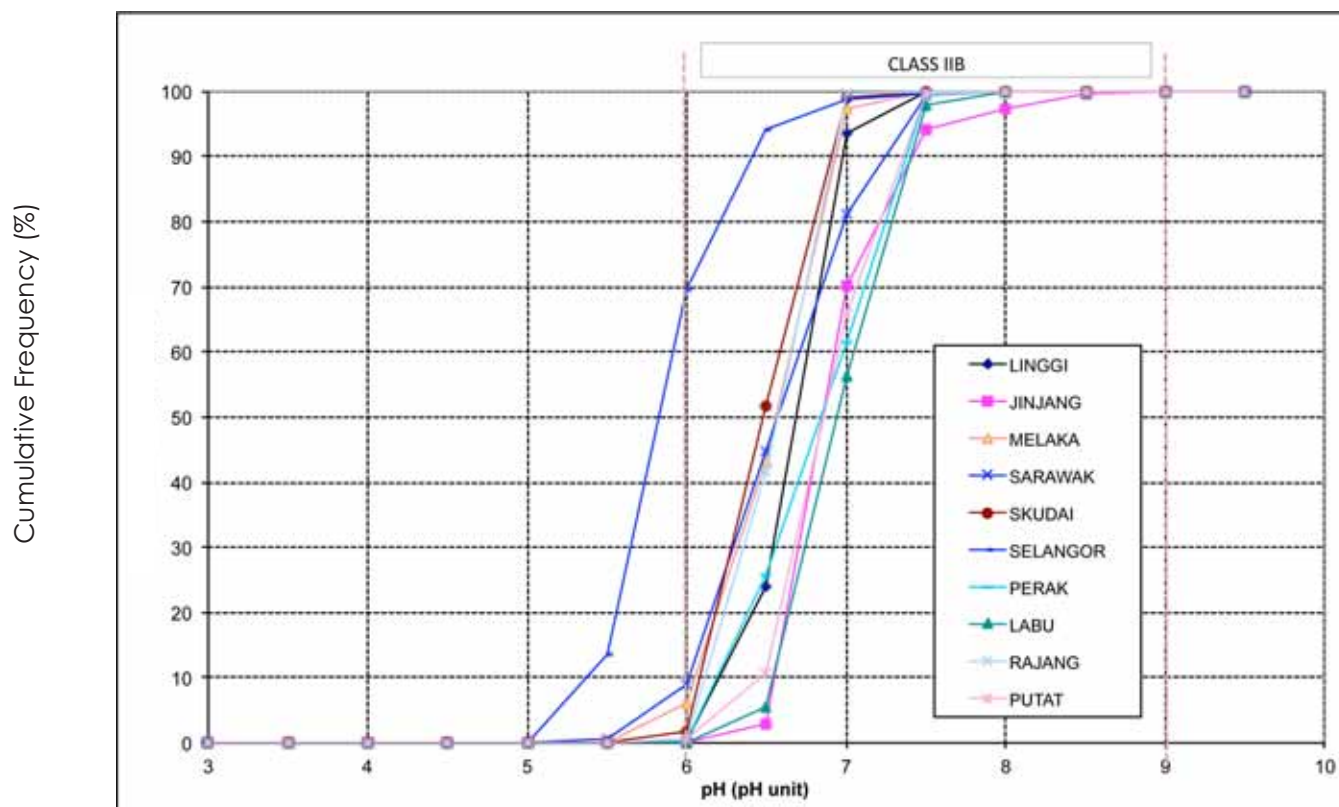


Figure 2.5. Comparison of Cumulative Frequency for 10 CWQM Stations - pH : 1st January - 31st December 2012

TREND IN RIVER WATER POLLUTION

The river water quality in terms of WQI had shown a slight improvement in 2012. The percentage of clean rivers of 59% in 2012 remained unchanged as compared to the previous year. However, the percentage of polluted river has decreased from 8% in previous year to 7%. Out of 473 rivers as shown in **Table 2.1, 2.2** and **2.3**, 36 rivers were found to have gained better water quality. Eleven (11) rivers had showed improved water quality from polluted to slightly polluted, and 25 rivers had improved from slightly polluted to clean status as compared to the year 2011.

In terms of BOD sub-index, the number of clean rivers had decreased from 44 (2011) to 36 in 2012 (**Figure 2.6**). For AN sub-index, the number of clean rivers had also decreased from 174 (2011) to 147 in 2012 (**Figure 2.7**). However, in term of SS sub-index, the number of clean rivers had significantly increased from 293 (2011) to 338 in 2012 (**Figure 2.8**). The quality improvement may have been contributed by successful control against improper earthworks and land clearing activities.

Heavy metals were analysed for Mercury (Hg), Arsenic (As), Cadmium (Cd), Chromium (Cr), Plumbum (Pb), and Zinc (Zn). All Pb, Cd and Zn data were within the Class IIB limits of the NWQS. Meanwhile, 99.97% of the data for Cr were within the Class IIB limits of the NWQS followed by Hg (99.96%) and As (99.68%).

Table 2.1 Malaysia: Water Quality Status of Clean Rivers, 2012

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
PERLIS	PERLIS	PELARIT	1	91	93	I	C
		WANG KELIAN	1	91	94	I	C
		JERNIH	1	90	87	II	C
		JARUM	1	83	83	II	C
KEDAH	ULU MELAKA	PETANG	1	95	94	I	C
		ULU MELAKA	1	82	84	II	C
	MERBOK	TUPAH	1	95	88	II	C
		TOK PAWANG	1	90	88	II	C
	KEDAH	JANING	1	94	93	I	C
		PEDU	1	87	88	II	C
	KISAP	KISAP	1	92	91	II	C
KEDAH/ P.PINANG	MUDA	PEGANG	1	95	91	I	C
		KETIL	2	94	86	I	C
		CHEPIR	1	92	86	II	C
		MUDA	4	92	89	II	C
		KARANGAN	1	90	87	II	C
		SEDIM	1	90	84	II	C
P.PINANG	JAWI	JUNJONG	1	91	90	II	C
	PINANG	AIR TERJUN	1	87	92	II	C
	KLUANG	ARA	2	87	86	II	C
	PERAI	KULIM	2	82	85	II	C
P.PINANG/ PERAK	KERIAN	KECHIL	1	90	90	II	C
PERAK	PERAK	CHEPOR	1	95	96	I	C
		KINJANG	1	91	91	II	C
		PELUS	2	91	90	II	C
		KLAH	1	90	89	II	C
		CHENDERIANG	1	88	85	II	C
		SUNGKAI	2	88	88	II	C
		PERAK	8	87	88	II	C
		KAMPAR	2	86	89	II	C
		KANGSAR	1	86	86	II	C
		KERDAH	1	68	83	II	C
		KINTA	6	77	81	II	C
		RAIA	2	86	87	II	C

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
		BIDOR	3	85	87	II	C
		BATANG PADANG	3	84	88	II	C
		KUANG	1	84	88	II	C
	SEPETANG	JANA	1	93	93	I	C
		TRONG	1	92	91	II	C
		LIMAU	1	88	88	II	C
		BATU TEGOH	3	87	86	II	C
		TEMERLOH	2	87	89	II	C
	KURAU	ARA	2	91	93	I	C
	RAJA HITAM	NYIOR	1	91	90	II	C
	BRUAS	ROTAN	1	90	89	II	C
		DANDANG	1	89	85	II	C
BRUAS		3	83	82	II	C	
PERAK/ SELANGOR	BERNAM	INKI	1	95	90	II	C
		TROLAK	1	92	90	II	C
		BERNAM	4	88	87	II	C
		SLIM	2	88	86	II	C
SELANGOR	SELANGOR	KERLING	1	94	93	I	C
		BATANG KALI	1	91	90	II	C
		KANCHING	1	90	92	II	C
		SERENDAH	1	90	90	II	C
		SELANGOR	4	83	84	II	C
	LANGAT	LUI	1	90	90	II	C
		SEMENYIH	1	88	88	II	C
		CHUAU	2	87	87	II	C
	JIJAN	1	87	84	II	C	
SELANGOR/ WPKL	KLANG	PENCHALA	1	NA	86	II	C
		SEMELAH	1	90	85	II	C
N.SEMBILAN	LINGGI	BATANG PENAR	1	93	94	I	C
		PEDAS	1	88	89	II	C
		REMBAU	2	88	84	II	C
		CHEMBONG	1	87	83	II	C
		SIPUT	1	85	82	II	C
MELAKA	MELAKA	TAMPIN	1	95	92	II	C
		KEMUNTING	1	89	89	II	C
		DUSUN/KERU	1	89	90	II	C
		BTG.MELAKA	2	87	87	II	C

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
		DURIAN TUNGGAL	1	81	82	II	C
	KESANG	CHOHONG	2	90	87	II	C
	DUYONG	GAPAM	1	87	91	II	C
JOHOR/ N.SEMBILAN	MUAR	AIR PANAS	1	91	94	I	C
		JUASSEH	1	89	92	II	C
		MUAR	8	80	82	II	C
		SEGAMAT	1	78	85	II	C
		GEMENCHEH	1	85	89	II	C
		MEDA	1	83	82	II	C
		LABIS	1	81	83	II	C
JOHOR	BATU PAHAT	BANTANG	1	92	93	I	C
		BEKOK	5	80	82	II	C
		CHAAH	1	90	84	II	C
		MEREK	1	90	87	II	C
		LENIK	1	88	84	II	C
	ENDAU	JASIN	1	92	92	II	C
		SELAI	1	92	90	II	C
		TAMOK	1	88	89	II	C
		ENDAU	3	87	86	II	C
		KAHANG	1	87	88	II	C
		SEMBERONG	5	80	81	II	C
		LENGGOR	1	77	81	II	C
		MAMAI	1	87	82	II	C
	PALOH	1	81	88	II	C	
	JOHOR	LAYANG	1	92	92	II	C
		PELEPAH	2	91	89	II	C
		PENGGELI	2	91	85	II	C
		PANTI	1	90	90	II	C
		LAYAU KIRI	1	88	86	II	C
		TELOR	1	88	87	II	C
		LINGGIU	1	87	84	II	C
		REMIS	1	87	82	II	C
		SEMANGAR	1	87	86	II	C
TEMOH		1	87	85	II	C	
ANAK SG. SAYONG		1	86	81	II	C	
SAYONG		4	86	82	II	C	
BUKIT BESAR		1	85	88	II	C	
BELITONG	1	84	86	II	C		

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
		JOHOR	4	84	82	II	C
		PAPAN	1	84	83	II	C
		SELUYUT	1	84	86	II	C
		SANTI	1	81	83	II	C
		TIRAM	4	81	81	II	C
	BENUT	PARIT HJ. YASSIN	1	90	83	II	C
	SEDILI BESAR	AMBAT	1	79	84	II	C
		DOHOL	1	80	87	II	C
		PASIR PANJANG	1	77	81	II	C
	JEMALUANG	JEMALUANG	2	78	85	II	C
	PULAI	PULAI	2	74	82	II	C
	PALOI	PALOI	1	87	87	II	C
	MERSING	MERSING	2	81	85	II	C
PAHANG	PAHANG	BURUNG	1	96	87	II	C
		TERANUM	1	95	95	I	C
		TERLA	1	94	86	II	C
		HABU	1	92	91	II	C
		KELAU	1	91	89	II	C
		RINGLET	1	91	90	II	C
		BENUS	2	90	93	II	C
		TASIK BERA	1	76	83	II	C
		TELANG	1	80	85	II	C
		BERKAPOR	1	90	89	II	C
		LENGGOK	1	90	90	II	C
		T. PAYA BUNGOR	1	90	86	II	C
		TEMBELING	1	90	87	II	C
		TERAS	1	90	94	I	C
		LIPIS	3	89	88	II	C
		MARAN	1	89	88	II	C
		PERTING	1	89	91	II	C
		TAHAN	1	89	89	II	C
		TERIS	3	89	82	II	C
		KERTAM	1	88	85	II	C
		LEPAR	3	88	86	II	C
		TANGLIR	1	88	89	II	C
		BENTONG	1	87	91	II	C
TASIK CHINI	1	87	85	II	C		
JEMPOL	2	86	85	II	C		

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
		LUIT	1	86	86	II	C
		TEKAL	1	86	81	II	C
		JELAI	2	85	84	II	C
		PAHANG	8	85	84	II	C
		TEKAM	2	85	85	II	C
		TRIANG	2	83	85	II	C
		KOYAN	1	82	88	II	C
		SEMANTAN	3	81	85	II	C
	KUANTAN	KENAU	1	90	88	II	C
		KUANTAN	5	88	86	II	C
		RIAU	1	80	82	II	C
		PANDAN	1	88	88	II	C
		CHARU	1	84	84	II	C
	MERCHONG	MERCHONG	1	90	91	II	C
	ROMPIN	KERATONG	2	88	85	II	C
		PUKIN	1	93	92	II	C
		ROMPIN	4	80	85	II	C
		PONTIAN	1	85	89	II	C
		AUR	1	84	87	II	C
	ANAK ENDAU	ANAK ENDAU	2	84	86	II	C
BEBAR	MERBA	1	84	81	II	C	
TERENGGANU	TERENGGANU	BERANG	1	92	86	II	C
		PUEH	1	89	88	II	C
		NERUS	1	77	82	II	C
		TERENGGANU	3	85	84	II	C
		TELEMONG	1	81	87	II	C
	KERTIH	KERTIH	1	92	85	II	C
	MERANG	MERANG	1	69	82	II	C
	BESUT	BESUT	2	91	90	II	C
	CHUKAI	IBOK	1	91	83	II	C
	DUNGUN	DUNGUN	4	90	91	II	C
	PAKA	RASAU	1	88	82	II	C
		PAKA	1	87	83	II	C
	SETIU	CHALOK	2	80	83	II	C
		SETIU	2	88	88	II	C
	KEMAMAN	CHERUL	1	87	87	II	C
		KEMAMAN	2	86	85	II	C
	MARANG	MARANG	1	81	84	II	C

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
KELANTAN	KELANTAN	KERILLA	1	94	92	II	C
		TUANG	1	94	95	I	C
		PERGAU	6	93	92	II	C
		BER	1	91	91	II	C
		BETIS	1	90	92	II	C
		GALAS	5	89	88	II	C
		NAL	2	89	91	II	C
		BEROK	3	88	86	II	C
		LEBIR	3	86	87	II	C
		NENGGIRI	3	86	86	II	C
		KELANTAN	3	85	85	II	C
		SOKOR	1	85	86	II	C
	RELAJ	1	83	87	II	C	
	GOLOK	LANAS	1	86	89	II	C
		GOLOK	5	85	87	II	C
KEMASIN	KEMASIN	2	72	81	II	C	
	SEMERAK	2	85	87	II	C	
PENKALAN CHEPA	KELADI	1	83	83	II	C	
SARAWAK	MIRI	PADANG LIKU	1	91	86	II	C
	LUPAR	AI	2	90	83	II	C
		SEKERANG	1	88	87	II	C
	LIMBANG	LIMBANG	5	89	88	II	C
	RAJANG	KANOWIT	1	87	86	II	C
		BINATANG	1	86	82	II	C
		SARIKEI	2	74	81	II	C
		BALOI	1	81	84	II	C
		JULAU	1	85	83	II	C
	TRUSAN	TRUSAN	1	86	90	II	C
	LAWAS	LAWAS	3	84	90	II	C
	BARAM	TUTUH	1	77	82	II	C
	SIBUTI	KEJAPIL	2	76	85	II	C
TATAU	TATAU	1	80	86	II	C	
SIMILAJAU	SIMILAJAU	2	82	84	II	C	
SARAWAK	SARAWAK KIRI	1	77	81	II	C	
SABAH	SUGUT	BONGKUD	1	95	94	I	C

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
		LOHAN	1	95	94	I	C
		SUGUT	3	90	91	II	C
		MERALI	1	93	92	II	C
	PADAS	BUNSIT	1	95	93	I	C
		LIAWAN	1	94	92	II	C
		TANDULU	1	94	92	II	C
		PANGATAN	1	90	88	II	C
		PEGALAN	3	88	90	II	C
		PADAS	3	85	85	II	C
		BINGKONGAN	BANDAU	1	94	92	II
	BINGKONGAN		2	94	90	II	C
	MENGGARIS		2	93	90	II	C
	TANDEK		1	90	89	II	C
	KEDAMAIAAN	TEMPASUK	2	94	92	II	C
		WARIU	1	94	91	II	C
		KEDAMAIAAN	1	93	91	II	C
	APAS	APAS	1	92	85	II	C
	LABOK	KINIPIR	2	92	92	II	C
		MALIAU	1	92	93	I	C
		LIWAGU	2	90	93	II	C
		TUNGUD	1	87	88	II	C
		LABOK	1	84	90	II	C
	LAKUTAN	LAKUTAN	1	92	91	II	C
	MOYOG	MOYOG	4	92	90	II	C
	SAPI	SUALONG	1	92	89	II	C
		SAPI	3	89	87	II	C
	PAPAR	PAPAR	3	91	89	II	C
TAWAU	TAWAU	4	91	88	II	C	
KALUMPANG	KALUMPANG	3	90	87	II	C	
MENGGALONG	MENGGALONG	2	90	90	II	C	
LIKAS	MENGGATAL	2	90	86	II	C	
	INANAM	3	85	84	II	C	
SILABUKAN	SILABUKAN	2	90	90	II	C	
TUARAN	TUARAN	2	90	93	I	C	

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
		SONG SAI	1	88	90	II	C
		DAMIT	2	85	89	II	C
	UMAS-UMAS	UMAS-UMAS	1	90	91	II	C
	KINABATANGAN	MENANGGUL	1	89	89	II	C
		KARAMUAK	1	88	90	II	C
		KINABATANGAN	3	87	88	II	C
		KOYAH	1	87	89	II	C
	MEROTAI	MEROTAI	3	89	89	II	C
	BALUNG	BALUNG	1	88	91	II	C
	BRANTIAN	BRANTIAN	1	88	92	II	C
	LINGKUNGAN	BUKAU	1	88	89	II	C
		LINGKUNGAN	1	87	92	II	C
	SEGAMA	SEGAMA	3	88	89	II	C
	TINGKAYU	TINGKAYU	2	88	91	II	C
	KIMANIS	KIMANIS	1	87	87	II	C
	SEGALIUD	SEGALIUD	2	87	87	II	C
	TENGHILAN	TENGHILAN	1	87	90	II	C
	TUNGKU	TUNGKU	2	87	88	II	C
	BENGGOKA	BENGGOKA	2	86	86	II	C
	KALABAKAN	KALABAKAN	3	86	88	II	C
	MEMBAKUT	MEMBAKUT	1	86	85	II	C
	MOUNAD	MOUNAD	2	86	91	II	C
	BONGAWAN	BONGAWAN	1	85	87	II	C
PAITAN	PAITAN	1	85	84	II	C	

Table 2.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2012

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
PERLIS	PERLIS	NGULANG	1	85	77	II	SP
		PERLIS	1	66	64	III	SP
KEDAH	KEDAH	PENDANG	1	80	76	II	SP
		KEDAH	1	59	63	III	SP
		PDG TERAP	3	82	78	II	SP
		TEKAI	1	86	79	II	SP
	MERBOK	MERBOK	1	74	64	III	SP
		BONGKOK	1	71	62	III	SP
KEDAH/ P.PINANG	MUDA	JERUNG	1	72	72	III	SP
P.PINANG	JAWI	MACHANG BUBOK	1	77	79	II	SP
	PERAI	KELADI	1	75	79	II	SP
		PERAI	2	55	62	III	SP
		JARAK	3	65	72	III	SP
	BAYAN LEPAS	TIRAM	2	75	74	III	SP
		BAYAN LEPAS	1	62	67	III	SP
	JURU	KILANG UBI	4	71	69	III	SP
		PASIR	1	63	61	III	SP
	KLUANG	RELAU	1	68	74	III	SP
	PINANG	DONDANG	1	42	61	III	SP
P.PINANG/ PERAK	KERIAN	SELAMA	2	72	72	III	SP
		KERIAN	4	82	77	II	SP
PERAK	KURAU	KURAU	4	79	78	II	SP
	PERAK	NYAMOK	1	74	76	III	SP
		KEPAYANG	2	71	75	III	SP
		SELUANG	1	69	62	III	SP
		PARI	1	68	79	II	SP
		SEROKAI	1	66	64	III	SP
		PINJI	2	64	68	III	SP
		TUMBOH	1	64	64	III	SP
	SEPETANG	SEPETANG	2	72	76	III	SP
	RAJA HITAM	MANJONG	2	70	76	III	SP
	WANGI	DERALIK	1	68	72	III	SP
		WANGI	1	63	77	II	SP
SELANGOR	TENGI	TENGI	3	77	76	III	SP
	LANGAT	LANGAT	7	75	73	III	SP
		PAJAM	1	74	75	III	SP
		ANAK CHUAU	1	72	75	III	SP

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
		BATANG NILAI	1	65	71	III	SP
	SEPANG	SEPANG	2	73	71	III	SP
	SELANGOR	SEMBAH	1	72	67	III	SP
SELANGOR/ WPKL	KLANG	BATU	3	77	75	II	SP
		AMPANG	2	NA	74	III	SP
		ANAK AIR BATU	1	NA	76	III	SP
		BUNOS	3	NA	65	III	SP
		DAMANSARA	2	NA	69	III	SP
		GOMBAK	3	84	78	II	SP
		JINJANG	1	53	65	III	SP
		KEROH	2	NA	76	III	SP
		RASAU	1	NA	77	II	SP
		TOBA	1	NA	61	III	SP
		UNTUT	1	NA	63	III	SP
		KLANG	9	61	64	III	SP
N.SEMBILAN	LINGGI	LINGGI	5	76	74	III	SP
		KUNDUR BESAR	1	84	74	III	SP
		KEPAYONG	1	84	80	II	SP
		SIMIN	1	75	69	III	SP
MELAKA	KESANG	KESANG	3	80	71	III	SP
	MELAKA	MELAKA	5	78	76	III	SP
		REMBIA	1	67	61	III	SP
	DUYONG	DUYONG	3	72	68	III	SP
JOHOR	BATU PAHAT	AMRAN	1	59	77	II	SP
		BERLIAN	1	75	78	II	SP
		MERPO	1	70	75	III	SP
		SEMBERONG	2	68	68	III	SP
		SIMPANG KIRI	3	67	69	III	SP
		SIMPANG KANAN	2	64	66	III	SP
		BATU PAHAT	1	60	68	III	SP
		TEMUBOR KANAN	1	77	80	II	SP
		SEDILI BESAR	5	78	79	II	SP
	SEDILI KECIL	SEDILI KECIL	2	80	79	II	SP
		ANAK SEDILI KECIL	1	78	76	III	SP
		BAHAN	2	74	79	II	SP
	ENDAU	MENKIBOL	3	75	74	III	SP
		PAMOL	1	73	73	III	SP
		SINGOL	1	84	76	III	SP

STATE	RIVER BASIN	RIVER	NO. OF STATIONS	WQI		RIVER (2012)		
				2011	2012	CLASS	CATEGORY	
JOHOR		JEBONG	1	65	72	III	SP	
		MELATAI	1	65	61	III	SP	
	JOHOR	CHEMANGAR	1	77	74	II	SP	
		SEBOL	1	84	79	II	SP	
		LEBAM	1	70	73	III	SP	
		SEMENCHU	1	64	65	III	SP	
	PULAI	ULU CHOHO	1	54	66	III	SP	
	BENUT	ULU BENUT	1	74	67	III	SP	
		BENUT	4	69	71	III	SP	
		PINGGAN	1	47	61	III	SP	
	PONTIAN KECIL	PONTIAN KECIL	2	70	75	III	SP	
	SKUDAI	SKUDAI	9	68	69	III	SP	
		MELANA	2	66	66	III	SP	
	PONTIAN BESAR	AIR HITAM	1	67	69	III	SP	
		PONTIAN BESAR	5	61	70	III	SP	
	TEBRAU	PLENTONG	4	56	60	III	SP	
		TEBRAU	4	56	66	III	SP	
	KIM-KIM	KIM-KIM	2	64	64	III	SP	
PAHANG	PAHANG	JENGA	2	80	79	II	SP	
		KUNDANG	1	77	76	III	SP	
		BERTAM	1	92	69	III	SP	
		CHINI	1	81	78	II	SP	
		TELOM	2	90	80	II	SP	
		TRINGKAP	1	91	80	II	SP	
		BERA	2	75	78	III	SP	
		MENTIGA	1	74	77	II	SP	
		SERTING	2	73	75	III	SP	
	KUANTAN	BELAT	1	85	79	II	SP	
		TALAM	1	85	77	II	SP	
	CHERATING	CHERATING	1	76	76	III	SP	
	BALOK	PANJANG	1	75	77	II	SP	
		BALOK	2	66	69	III	SP	
	BEBAR	SERAI	2	71	71	III	SP	
		BEBAR	1	65	61	III	SP	
	TONGGOK	TONGGOK	1	69	70	III	SP	
	TERENGGANU	CHUKAI	CHUKAI	1	79	77	II	SP

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)		
				2011	2012	CLASS	CATEGORY	
		BUNGKUS	1	81	76	III	SP	
		RUANG	1	71	76	III	SP	
	IBAI	IBAI	3	77	78	II	SP	
	KLUANG	KLUANG	1	81	80	II	SP	
	MERCHANG	MERCHANG	1	69	65	III	SP	
KELANTAN	PENKALAN DATU	PENKALAN DATU	3	79	75	III	SP	
	PENKALAN CHEPA	PENKALAN CHEPA	2	71	76	III	SP	
		RAJA GALI	1	68	80	II	SP	
	KELANTAN	BELATOP	2	85	77	II	SP	
SARAWAK	LUPAR	LUPAR	3	80	72	II	SP	
		SETERAP	1	81	72	II	SP	
		UNDUP	1	84	78	III	SP	
	NIAH	SEKALOH	1	81	79	II	SP	
		NIAH	2	80	80	II	SP	
	SARAWAK	SARAWAK	SARAWAK KANAN	1	80	78	II	SP
			SARAWAK	6	79	77	II	SP
			SAMARAHAN	2	77	69	III	SP
			SEMADANG	1	77	80	II	SP
			KUAP	1	75	70	III	SP
			TABUAN	1	75	69	III	SP
			MAONG KIRI	1	69	69	III	SP
		SEMENGGOH	1	68	65	III	SP	
	BALINGIAN	BALINGIAN	2	79	76	III	SP	
	SUAI	SUAI	1	79	76	III	SP	
	SIBUTI	SIBUTI	SATAP	1	59	72	III	SP
			SIBUTI	2	76	79	II	SP
			KABULOH	2	62	71	III	SP
	BARAM	BARAM	4	73	73	III	SP	
	KAYAN	KAYAN	3	76	71	III	SP	
	SARIBAS	SARIBAS	LAYAR	2	76	74	III	SP
			SARIBAS	1	65	72	III	SP
	RAJANG	RAJANG	RAJANG	11	76	79	II	SP
MERADONG			1	71	74	III	SP	
SALIM			1	71	79	II	SP	

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
	KERIAN	SEBLAK	1	76	65	III	SP
		KERIAN	2	74	65	III	SP
	KEMENA	SIBIU	1	76	80	II	SP
		KEMENA	3	75	79	II	SP
	MUKAH	MUKAH	4	73	75	III	SP
	SADONG	SADONG	4	73	76	III	SP
		KARANGAN	2	72	79	II	SP
	SEMUNSAM	SEMUNSAM	1	81	70	III	SP
	OYA	OYA	3	72	75	III	SP
	MIRI	MIRI	2	65	64	III	SP
		ADONG	1	59	63	III	SP
		DALAM	1	64	69	III	SP
		LUTONG	1	64	72	III	SP
	SABAH	LIKAS	LIKAS	2	75	79	II
TELIPOK		TELIPOK	2	85	79	II	SP
SEMBULAN		SEMBULAN	2	62	67	III	SP

Table 2.3 Malaysia: Water Quality Status of Polluted Rivers, 2012

STATE	RIVER BASIN	RIVER	NO.OF STATIONS	WQI		RIVER (2012)	
				2011	2012	CLASS	CATEGORY
KEDAH	MERBOK	PETANI	1	59	58	III	P
P.PINANG	PINANG	AIR ITAM	5	57	59	III	P
		PINANG	1	44	56	III	P
		JELUTONG	1	43	36	IV	P
	PERAI	PERTAMA	1	50	47	IV	P
		KEREH	2	45	50	IV	P
	JURU	JURU	2	54	47	IV	P
		RAMBAI	1	52	53	III	P
JAWI	JAWI	1	42	44	IV	P	
PERAK	RAJA HITAM	RAJA HITAM	2	53	57	III	P
SELANGOR	BULOH	BULOH	4	58	56	III	P
MELAKA	MERLIMAU	MERLIMAU	2	53	52	IV	P
	SERI MELAKA	SERI MELAKA	1	62	55	III	P
JOHOR/ N.SEMBILAN	MUAR	SARANG BUAYA	1	59	58	III	P
JOHOR	RAMBAH	RAMBAH	2	59	59	III	P
	KAW. PASIR GUDANG	LATOH	1	58	54	III	P
		MASAI	1	52	51	IV	P
		PEREMBI	1	48	56	III	P
		BULUH	1	33	48	IV	P
		TUKANG BATU	1	26	35	IV	P
	TEBRAU	PANDAN	1	57	59	III	P
		TAMPOI	1	57	50	IV	P
		SEBULUNG	1	65	44	IV	P
		BALA	1	51	57	III	P
		SENGKUANG	1	42	36	IV	P
	SEGGET	SEGGET	5	53	58	III	P
	KEMPAS	KEMPAS	2	51	55	III	P
	DANGA	DANGA	2	49	55	III	P
	PONTIAN BESAR	AYER MERAH	1	47	29	V	P
SANGLANG	SANGLANG	1	47	52	III	P	
AIR BALOI	AIR BALOI	3	41	50	IV	P	
KELANTAN	PENKALAN CHEPA	ALOR B	1	61	59	III	P
		ALOR LINTAH	1	53	48	IV	P
TERENGGANU	KEMAMAN	RANSAN	1	60	50	IV	P

Table 2.4 Malaysia : The Polluted Rivers and Classes Based on BOD, AN and SS, 2012

STATE	RIVER BASIN	RIVER	2012		Classes based on:		
			WQI	CLASS	BOD	AN	SS
P.PINANG	PINANG	AIR ITAM	59	III	IV	IV	I
JOHOR	TEBRAU	PANDAN	59	III	IV	V	I
JOHOR	RAMBAH	RAMBAH	59	III	V	II	III
KELANTAN	PENKALAN CHEPA	ALOR B	59	III	IV	V	I
JOHOR/ N.SEMBILAN	MUAR	SARANG BUAYA	58	III	V	II	III
JOHOR	SEGGET	SEGGET	58	III	IV	IV	I
KEDAH	MERBOK	PETANI	58	III	IV	IV	II
PERAK	RAJA HITAM	RAJA HITAM	57	III	IV	IV	II
JOHOR	TEBRAU	BALA	57	III	IV	V	I
P.PINANG	PINANG	PINANG	56	III	IV	IV	I
JOHOR	KAW. PASIR GUDANG	PEREMBI	56	III	IV	V	II
SELANGOR	BULOH	BULOH	56	III	IV	IV	II
MELAKA	SERI MELAKA	SERI MELAKA	55	III	IV	IV	II
JOHOR	DANGA	DANGA	55	III	IV	IV	II
JOHOR	KEMPAS	KEMPAS	55	III	V	V	III
JOHOR	KAW. PASIR GUDANG	LATOH	54	III	IV	IV	II
P.PINANG	JURU	RAMBAI	53	III	IV	V	II
JOHOR	SANGLANG	SANGLANG	52	III	V	II	V
MELAKA	MERLIMAU	MERLIMAU	52	III	V	V	II
JOHOR	KAW. PASIR GUDANG	MASAI	51	IV	IV	V	II
TERENGGANU	KEMAMAN	RANSAN	50	IV	V	V	III
P.PINANG	PERAI	KEREH	50	IV	IV	V	II
JOHOR	AIR BALOI	AIR BALOI	50	IV	V	II	IV
JOHOR	TEBRAU	TAMPOI	50	IV	V	V	I
JOHOR	KAW. PASIR GUDANG	BULUH	48	IV	V	IV	III
KELANTAN	PENKALAN CHEPA	ALOR LINTAH	48	IV	V	V	II
P.PINANG	JURU	JURU	47	IV	V	V	II
P.PINANG	PERAI	PERTAMA	47	IV	IV	IV	III
P.PINANG	JAWI	JAWI	44	IV	V	V	III
JOHOR	TEBRAU	SEBULUNG	44	IV	V	V	I
P.PINANG	PINANG	JELUTONG	36	IV	V	V	II
JOHOR	TEBRAU	SENGKUANG	36	IV	V	V	II
JOHOR	KAW. PASIR GUDANG	TUKANG BATU	35	IV	V	V	III
JOHOR	PONTIAN BESAR	AYER MERAH	29	V	V	IV	II

	Class I
	Class II
	Class III
	Class IV

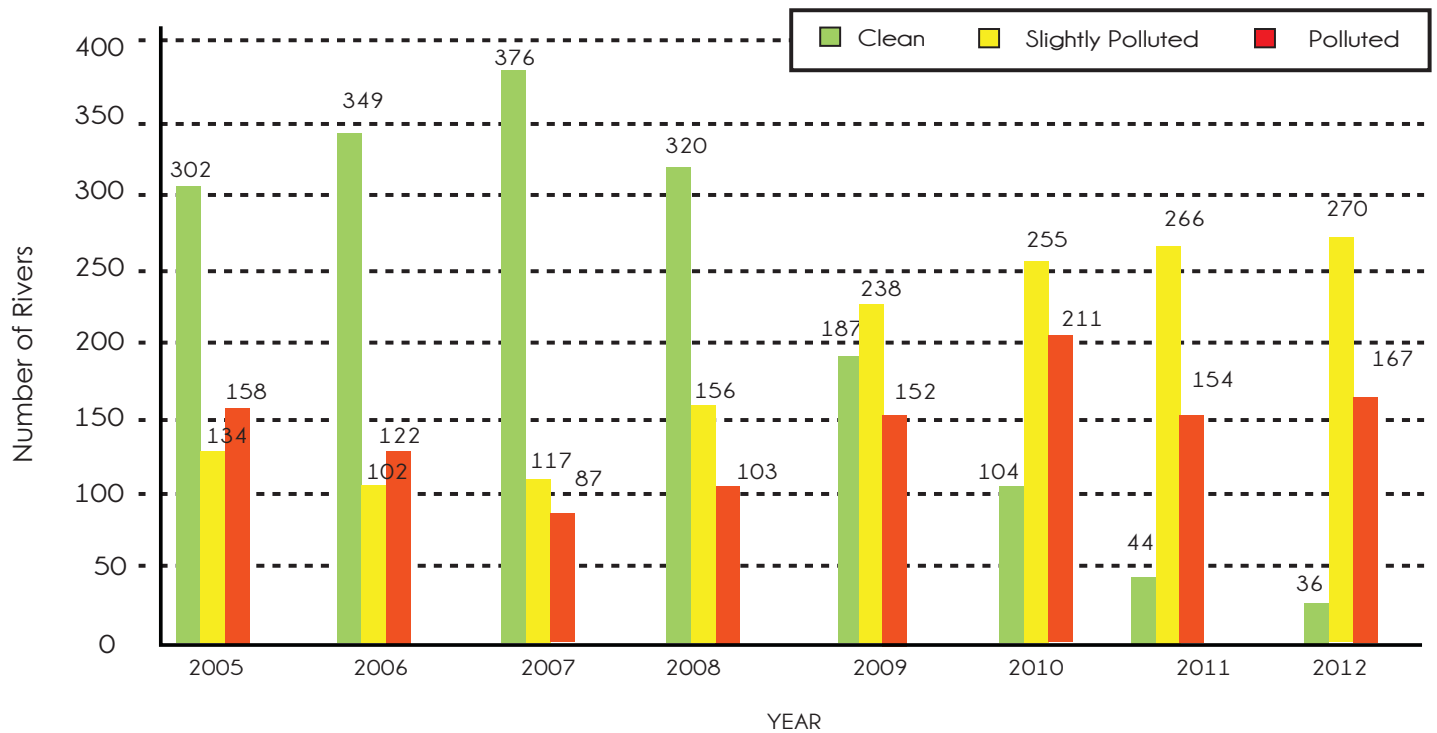


Figure 2.6 : River Water Quality Trend based on BOD sub-index (2005 - 2012)

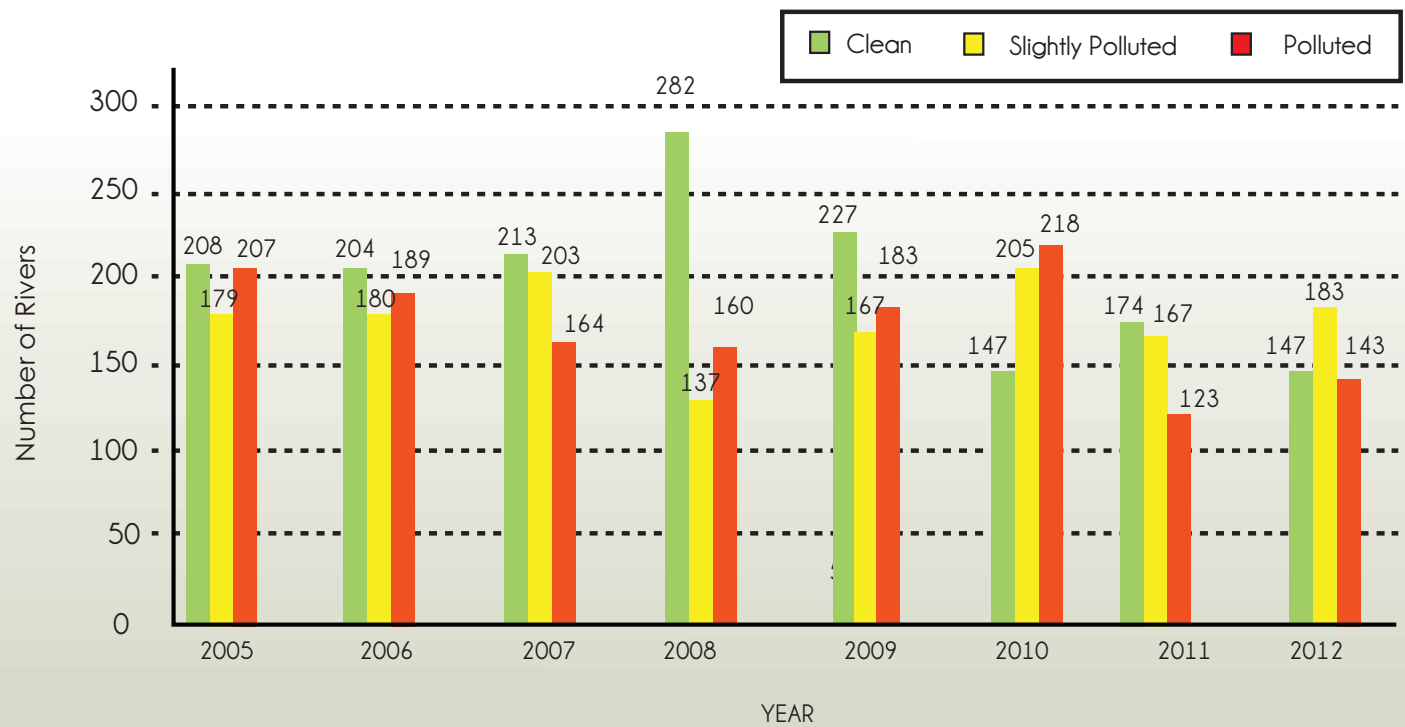


Figure 2.7 :River Water Quality Trend based on AN sub-index (2005 - 2012)

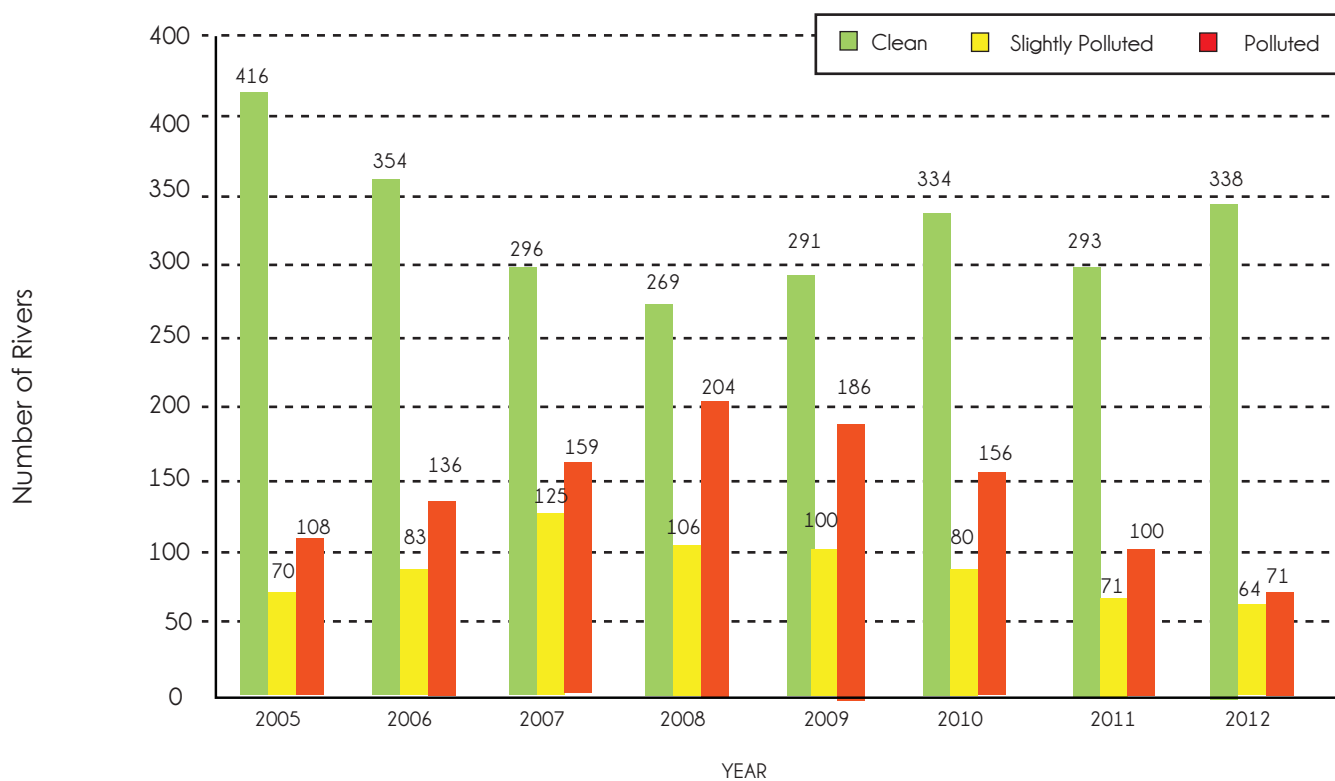
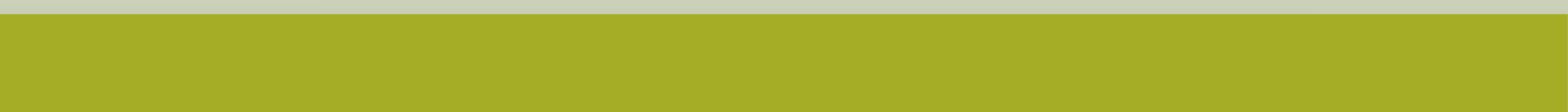


Figure 2.8 : River Water Quality Trend based on SS sub-index (2005 - 2012)





CHAPTER 3



GROUNDWATER QUALITY

GROUNDWATER QUALITY MONITORING

The National Groundwater Monitoring Programme was established since 1997 and currently, the monitoring was carried out at 79 monitoring wells in Peninsular Malaysia, 13 wells in Sarawak and 15 wells in Sabah (**Table 3.1**). The sites selected represented specific land uses 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).

In 2012, 361 water samples were taken from these active 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 their respective qualities.

GROUNDWATER QUALITY STATUS

The assessment of groundwater quality was based on the percentage of samples exceeded the National Guidelines for Raw Drinking Water Quality 2000 (NGRDWQ). The range between 0% to 49% exceedances were categorized as "low"; 50 - 79% as "moderate"; and 80 - 100% as "high".

In 2012, the results of monitoring showed that all stations were within the NGRDWQ except for arsenic (As), iron (Fe), manganese (Mn), total coliform and phenol (**Figure 3.1**).

Total coliform was categorized as high in terms of exceedance to the NGRDWQ and in fact were recorded at all stations, followed by phenol, Fe, Mn and As.

The high exceedances for phenol and iron were recorded at certain stations located in all states, mainly industrial sites and solid waste landfills.

As for manganese and arsenic, the exceedances to the NGRDWQ were relatively low at all stations in all states except for Perak, Melaka and Johor which recorded high exceedance for Mn. Detailed analysis is shown in (**Table 3.3**).



Table 3.1 Malaysia : Number of groundwater wells by land use category, 2012

Category	Number of Wells
Agricultural Areas	12
Urban/Suburban Areas	11
Industrial Sites	18
Solid Waste Landfills	24
Golf Courses	7
Rural Areas	3
Ex-mining Areas (Gold Mine)	3
Municipal Water Supply	7
Animal Burial Areas	14
Aquaculture Farms	6
Radioactive Landfill	1
Resorts	1
Total	107

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

Parameter	Symbol	Unit	Benchmark
Sulphate	SO ₄ ⁻	mg/l	250
Hardness	CaCO ₃	mg/l	500
Nitrate	NO ₃ ⁻	mg/l	10
Coliform	—		Must not be detected in any 100 ml sample
Manganese	Mn	mg/l	0.1
Chromium	Cr	mg/l	0.05
Zinc	Zn	mg/l	3
Arsenic	As	mg/l	0.01
Selenium	Se	mg/l	0.01
Chloride	Cl	mg/l	250
Phenolics	—	mg/l	0.002
TDS	—	mg/l	1000
Iron	Fe	mg/l	0.3
Copper	Cu	mg/l	1.0
Lead	Pb	mg/l	0.01
Cadmium	Cd	mg/l	0.003
Mercury	Hg	mg/l	0.001

Source: Ministry of Health, Malaysia

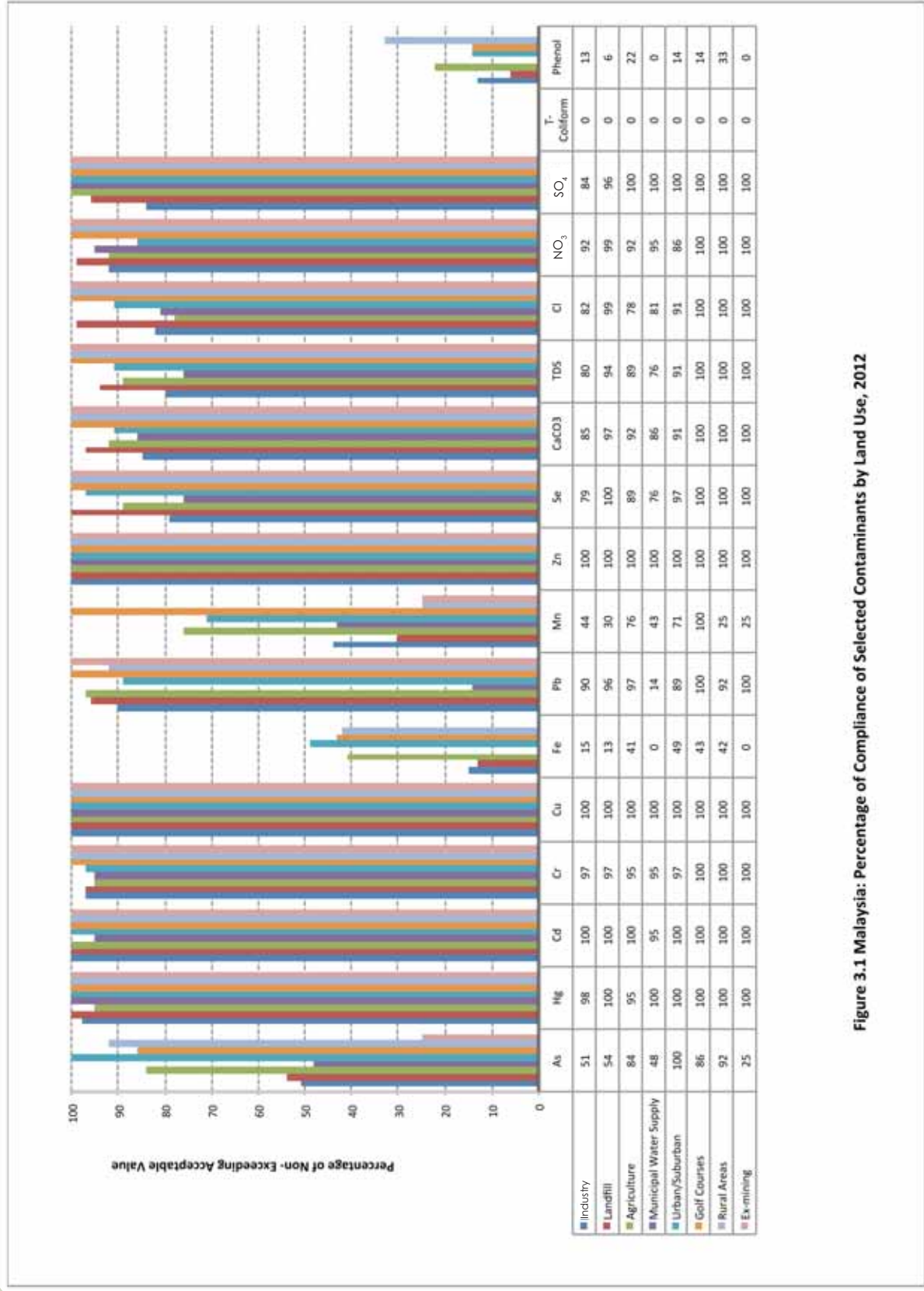
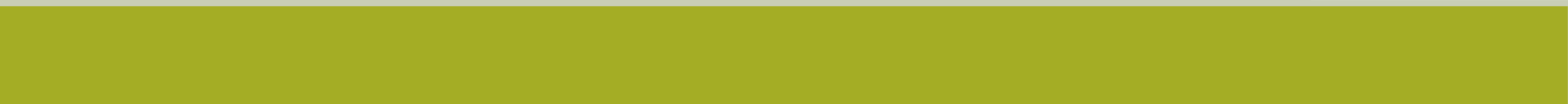


Figure 3.1 Malaysia: Percentage of Compliance of Selected Contaminants by Land Use, 2012

State	No. of Station	Station Description	The Percentage of Exceedance NGRDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Sabah	15	1) Labuan	100	0	0	100	100
		2) ITAC, Penampang (1)	0	100	100	100	100
		3) ITAC, Penampang(2)	100	100	100	100	100
		4) ITAC, Penampang (3)	100	100	100	100	100
		5) ITAC, Penampang (4)	0	100	100	100	100
		6) ITAC, Penampang(5)	0	100	100	100	100
		7) ITAC, Penampang(6)	0	100	100	100	100
		8) ITAC, Penampang(7)	100	100	100	100	100
		9) Limbawang	0	100	0	100	100
		10)Tawau	100	0	0	100	100
		11) Kg. Tajau Laut	0	100	0	100	100
		12) Sandakan Golf Club no.1	100	0	0	100	100
		13) Sandakan Golf Club no.1	100	0	0	100	100
		14) Inanam	0	100	100	100	100
		15) Pulau Manukan	100	100	0	100	100
Sarawak	13	1) Kemuyang no.1	25	100	100	100	100
		2) Kemuyang no.2	0	100	0	100	100
		3) Kabong	67	100	67	100	100
		4) Kuala Lawas no.1	50	100	50	100	100
		5) Kuala Lawas no.2	100	100	100	100	100
		6) Laku	25	100	0	100	100
		7) Kg. Lusut Kanan	0	100	100	100	100
		8) Kg. Lusut Kiri	100	100	50	100	100
		9) Bau no.1	100	100	100	100	100
		10) Bau no.2	75	100	100	100	100
		11) Bau	50	100	25	100	100
		12) Oya no.1	0	100	100	100	100
		13) Oya no.2	0	100	100	100	100
Terengganu	13	1) Kerteh no.1	0	50	0	100	75
		2) Kerteh no.2	0	100	0	100	50
		3) Telok Kalong no.1	0	100	0	100	75
		4) Telok Kalong no.2	0	100	100	100	50
		5) Kg. Kubang Badak no.1, K.Treg	0	100	0	100	100
		6) Kg. Kubang Badak no.2, K.Treg	0	100	0	100	75
		7) Kg. Merang,Setiu	0	0	0	100	75
		8) Kg. Alor Peroi no.1	0	100	25	100	75
		9) Kg. Alor Peroi no.2	0	100	75	100	25
		10) Kg. Alor Peroi no.3	25	100	100	100	50
		11) Kg. Raja no.1 , Besut	0	0	0	100	50
		12) Kg. Raja no.2, Besut	0	100	50	100	75
		13) Bukit Payung, Marang	0	75	100	100	50

State	No. of Station	Station Description	The Percentage of Exceedance NGRDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Pahang	8	1) Nenasi	0	100	100	100	100
		2) Lepar	0	100	0	100	100
		3) Agrobrest no.2, Nenasi	0	100	100	100	100
		4) Agrobrest no.3, Nenasi	0	100	100	100	100
		5) Agrobrest no.4, Nenasi	100	100	100	100	100
		6) Agrobrest no.5, Nenasi	0	100	0	100	100
		7) Agrobrest no.6, Nenasi	0	100	100	100	100
		8) Agrobrest no.7, Nenasi	100	100	0	100	100
Johor	6	1) Tg. Puteri, Pasir Gudang (MUCC)	100	100	100	100	100
		2) Tg. Puteri, Pasir Gudang	75	100	100	100	100
		3) Kota Tinggi	100	100	100	100	100
		4) Ulu Choh (Pintu)	100	100	75	100	25
		5) Ulu Choh (Kolam)	67	100	100	100	0
		6) Ulu Choh (Sungai)	100	100	100	100	0
Kedah	4	1) Kulim Hi-tech	100	100	100	100	100
		2) Kepala Batas	0	100	0	100	100
		3) Pulau Langkawi no.1	0	0	0	100	100
		4) Pulau Langkawi no.2	67	100	0	100	100
Perlis	3	1) Arau no.1	0	100	0	100	100
		2) Arau no.2	0	50	50	100	100
		3) Padang Besar	0	50	0	100	100
Kelantan	13	1) Eastern Garment MFG no.1	0	25	0	100	75
		2) Eastern Garment MFG no.2	25	25	25	100	75
		3) Panji no.1	0	75	25	100	75
		4) Panji no.2	0	75	0	100	75
		5) Pasir Mas	0	100	100	100	75
		6) Kampong Jembal	50	75	25	100	100
		7) Beris Lalang	0	0	0	100	75
		8) Rantau Panjang no.1	0	0	25	100	75
		9) Rantau Panjang no.2	0	50	0	100	75
		10) Kelab Golf & Desa no.1	0	100	0	100	75
		11) Kelab Golf & Desa no.2	0	100	0	100	75
		12) Bachok no.1	0	0	25	100	75
		13) Bachok no.2	25	100	100	100	75
Melaka	1	1) Petronas Sungai Udang	100	100	100	100	100
Perak	4	1) Batu Gajah	100	100	100	100	100
		2) Tambun	100	100	100	100	100
		3) Jalong no.1	0	100	75	100	100
		4) Jalong no.2	0	75	75	100	100
Kuala Lumpur	6	1) Jln. Sungai Besi no.1	100	100	100	100	100
		2) Jln. Sungai Besi no.2	100	100	100	100	100
		3) Jln. Sungai Besi no.3	50	0	75	100	100
		4) Taman Beringin no.1	100	100	100	100	100
		5) Taman Beringin no.2	100	100	100	100	100
		6) Royal Selangor Golf Club	0	0	0	100	100

State	No. of Station	Station Description	The Percentage of Exceedance NGRDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Selangor	8	1) Sek Keb Seksyen 20, Shah Alam	0	100	0	100	100
		2) CIAST no.1, Shah Alam	50	100	100	100	100
		3) CIAST no.2, Shah Alam	75	100	100	100	100
		4) Saujana Golf Resort no.1, Subang	0	50	0	100	100
		5) Saujana Golf Resort no.2, Subang	0	0	0	100	100
		6) Rumah India, Sepang	75	75	50	100	100
		7) TNB Sepang	25	25	25	100	100
		8) Ladang Sepang	50	75	0	100	100
Pulau Pinang	5	1) Mak Mandin no.1	100	100	100	100	100
		2) Mak Mandin no.2	100	100	100	100	100
		3) Bayan Lepas	100	100	100	100	100
		4) Valdor (Kelapa)	100	100	100	100	100
		5) Valdor (Tengah)	50	100	50	100	100
Negeri Sembilan	3	1) Senawang	100	100	0	100	100
		2) Kualiti Alam Sdn. Bhd no.1	100	100	100	100	100
		3) Kualiti Alam Sdn. Bhd no.2	0	0	100	100	100



CHAPTER 4



MARINE AND ISLAND MARINE WATER QUALITY

MARINE WATER QUALITY MONITORING

The Department of Environment (DOE) continues to monitor the marine water quality monitoring that started since 1978 in Peninsular Malaysia and 1985 in Sabah and Sarawak with the main aim to identify the marine water quality status and to determine the degree of pollution from both the land-based sources as well as the sea. These sources may pose threats to the marine resources and can upset the stability and diversity of the marine ecosystem.

In 2012, about 168 coastal, 78 estuary monitoring stations and 76 islands were monitored. A total of 579 samples from coastal, 325 samples from estuary and 190 samples from island monitoring stations were collected for analyses based on a newly developed Marine Water Quality Index (MWQI) (ANNEX).

The MWQI is used as a way to reflect the marine water quality status and category. The index was developed based on seven (7) main parameters which are Dissolved Oxygen (DO), Nitrate (NO_3), Phosphate (PO_4), Unionized Ammonia (NH_3), Faecal Coliform, Oil and Grease (O&G) and Total Suspended Solids (TSS).

The resulting MWQI with scales between 0 to 100 will designate the assigned categories of water quality, ranging from "excellent" to "poor" (**Table 4.1**).

The Class 1 and Class 2 waters classified under Marine Water Quality Criteria and Standards (MWQCS) generally require index values equal to or greater than 80 and are categorized at least as "Good" water quality (**Table 4.2**). The Class 3 waters of the MWQCS are generally within the moderate category of the MWQI.

Table 4.1: Marine Water Quality Index Classification

Category	Index Value
Excellent	90 -100
Good	80 - <90
Moderate	50 - <80
Poor	0 - <50

Table 4.2 Malaysia : Marine Water Quality Criteria and Standards

Parameter	CLASS 1	CLASS 2	CLASS 3	CLASS E
USES	Preservation, Marine Protected Areas, Marine Parks	Marine Life, Fisheries, Coral Reefs, Recreational and Mariculture	Ports, Oil & Gas Fields	Mangroves Estuarine & River-mouth Water
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
Dissolved oxygen (mg/L)	>80% saturation	5	3	4
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.
Oil and grease (mg/L)	0.01	0.14	5	0.14
Mercury* (µg/L)	0.04	0.16 (0.04)	50	0.5
Cadmium (µg/L)	0.5	2 (3)	10	2
Chromium(VI) (µg/L)	5	10	48	10
Copper (µg/L)	1.3	2.9	10	2.9
Arsenic (III)* (µg/L)	3	20(3)	50	20 (3)
Lead (µg/L)	4.4	8.5	50	8.5
Zinc (µg/L)	15	50	100	50
Cyanide (µg/L)	2	7	20	7
Ammonia (unionized) (µg/L)	35	70	320	70
Nitrite (NO ²) (µg/L)	10	55	1,000	55
Nitrate (NO ³) (µg/L)	10	60	1,000	60
Phosphate (µg/L)	5	75	670	75
Phenol (µg/L)	1	10	100	10
Tributyltin (TBT) (µg/L)	0.001	0.01	0.05	0.01
Faecal coliform	70 faecal coliform 100mL ⁻¹	100 faecal coliform 100mL ⁻¹ & (70 faecal coliform 100mL ⁻¹)	200 faecal coliform 100mL ⁻¹	100 faecal coliform 100mL ⁻¹ & (70 faecal coliform 100mL ⁻¹)
Polycyclic Aromatic Hydrocarbon (PAHs) µg/L	100	200	1000	1000

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

COASTAL WATER QUALITY STATUS

A total of 168 coastal stations were monitored in 2013. Of the total, only 155 were analyzed for the Marine Water Quality Index based on data availability. The result from the monitoring programme indicated three (3) stations (1.9%) were categorized as excellent, 32 stations (20.6%) as good, 111 stations (71.6%) as moderate and nine (9) stations (5.8%) as poor. **(Table 4.3)**



Table 4.3 Malaysia : Marine Water Quality Index for Coastal Water Status

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value			CATEGORY (2012)
				2010	2011	2012	
Kedah	Coastal	Pantai Merdeka	5603905	71.62	71.62	71.62	Moderate
		Langkawi Island Resort	6399914	73.60	73.60	73.60	Moderate
		Pantai Kok	6397922	60.45	60.45	60.45	Moderate
		Pantai Kuah	6398925	74.13	74.13	74.13	Moderate
		Pantai Pasir Tengkorak	6499701	72.87	72.87	72.87	Moderate
		Pantai Teluk Burau	6396923	56.11	56.11	56.11	Moderate
		Pantai Teluk Nibong	6497915	54.93	54.93	54.93	Moderate
Pulau Pinang	Coastal	Gertak Sanggul	5201919	83.24	82.18	58.29	Moderate
		Kawasan Perindustrian Bayan Lepas I	5303932	66.12	62.54	61.00	Moderate
		Kawasan Perindustrian Bayan Lepas II	5303933	65.57	63.09	62.33	Moderate
		Kawasan Perindustrian Bayan Lepas III	5302939	66.95	58.78	55.65	Moderate
		Pantai Bersih	5403906	64.04	72.19	52.38	Moderate
		Pantai Miami	5502901	86.81	83.37	65.52	Moderate
		Pantai Pasir Panjang	5201938	87.70	74.15	63.02	Moderate
		Batu Feringgi (Casuarina)	5402904	86.49	61.16	81.13	Good
		Luar Pantai Teluk Bahang	5402930	83.16	84.28	68.52	Moderate
		Persiaran Gurney	5403902	81.15	61.85	68.05	Moderate
		Rumah Pam Baru Perai	5304927	64.57	64.92	50.48	Moderate
		Rumah Pam Lama Perai	5303926	66.63	66.63	61.60	Moderate
		Selat PP Selatan (Jelutong)	5303911	65.34	61.49	58.13	Moderate
		Tanjung Bungah	5402937	73.34	61.61	51.98	Moderate
		Teluk Tempoyak	5202923	64.42	74.03	77.99	Moderate

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value			CATEGORY (2012)
				2010	2011	2012	
Perak	Coastal	Pantai Pasir Bogak	4205908	62.23	62.23	55.69	Moderate
		Pantai Teluk Dalam	4205928	87.90	87.90	39.94	Poor
		Pantai Teluk Batik	4205932	88.55	88.55	60.35	Moderate
		Pantai Tanjung Batu	4406927	40.32	40.32	40.32	Poor
		Pantai Pasir Panjang	4205924	63.16	63.16	63.16	Moderate
Selangor	Coastal	Pantai Bagan Lalang	2616927	63.51	63.51	90.57	Excellent
		Pantai Morib	2712902	52.18	52.18	75.03	Moderate
		Selat Pulau Babi	3012929	63.47	63.47	90.98	Excellent
		Selat Klang Utara	3013908	65.82	65.82	89.14	Good
Negeri Sembilan	Coastal	Bagan Pinang	2518915	64.85	72.47	72.47	Moderate
		Telok Sinting	2419908	81.61	65.90	65.90	Moderate
		Port Dickson Bandar	2517907	57.57	66.45	66.45	Moderate
		Port Dickson Batu 5	2418906	62.55	81.60	81.60	Good
		Port Dickson Batu 6	2418916	63.11	89.61	89.61	Good
		Port Dickson Batu 7	2418905	52.26	64.49	64.49	Moderate
		Port Dickson Batu 8	2418912	80.65	75.72	75.72	Moderate
		Port Dickson Batu 10	2418914	81.43	66.34	66.34	Moderate
		Port Dickson Janakuasa TNB	2517909	52.87	66.19	66.19	Moderate
		Telok Pelanduk	2419917	86.81	80.93	80.93	Good
Pantai Cermin	2416918	89.19	89.19	89.19	Good		
Melaka	Coastal	Pantai Rombang	2221916	64.83	67.61	66.36	Moderate
		Pantai Kundur	2221908	62.97	52.39	79.71	Moderate
		Pantai Tanjung Bidara	2320909	62.14	61.21	76.56	Moderate
		Teluk Gong	2320902	65.15	55.02	79.24	Moderate
		Pulau Melaka Point A(i)	2121915	54.96	43.76	50.24	Moderate
		Pulau Melaka Point A(ii)	2121915	49.15	49.15	49.15	Poor
		Pulau Melaka Point B(i)	2121916	54.85	48.08	48.31	Poor
		Pulau Melaka Point B(ii)	2121916	49.61	49.61	49.61	Poor
Johor	Coastal/ Straits	Tanjung Bin	1336975	87.65	87.65	88.98	Good
		Pelabuhan Tanjung Pelepas	1438943	88.09	88.09	86.35	Good
		Hadapan Jabatan Laut	1438918	54.77	54.77	66.86	Moderate
		Pantai Stulang Laut	1437951	70.74	70.74	61.36	Moderate
		Jeti Teluk Jawa	1438918	64.70	64.70	62.37	Moderate
		Pelabuhan Pasir Gudang	1428939	66.24	66.24	61.48	Moderate
		Hadapan HSAJB	1437920	66.66	66.66	54.37	Moderate
	Coastal	Pantai Lido	1437921	67.01	67.01	55.94	Moderate
		Pantai Teluk Mahkota	1841911	72.06	80.46	78.57	Moderate
		Pantai Tanjung Leman	2140694	85.49	82.79	78.72	Moderate
		Pantai Sri Pantai	2339960	72.72	80.26	80.02	Good
		Tanjung Merak	1441968	76.72	81.54	82.82	Good

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value			CATEGORY (2012)
				2010	2011	2012	
		Tanjung Pengelih	1441967	94.33	82.93	83.31	Good
		Pantai Tanjung Stapa	1341961	68.61	78.24	81.10	Good
		Pantai Teluk Gorek	2538958	91.59	-	84.07	Good
		Pantai Air Papan	2538959	91.63	87.02	82.50	Good
		Jeti Kukup	1334925	52.90	62.69	86.43	Good
		Jeti Tanjung Belungkor	1440963	93.30	80.14	84.21	Good
		Pasir Gogok	1441966	92.98	69.26	83.94	Good
		Tanjung Buai	1340973	93.44	86.44	84.61	Good
		Pantai Desaru	1542914	90.39	92.51	85.33	Good
		Tanjung Sepang	1443969	74.58	90.82	84.86	Good
		Tanjung Penyusup	1444920	73.94	89.52	82.21	Good
		Pantai Sungai Lurus	1730962	92.73	52.07	81.76	Good
		Punggur	1531974	55.44	52.45	68.18	Moderate
Pahang	Coastal	Pantai Cherating (Club Med)	4133903 A)	79.44	79.44	70.48	Moderate
		Pantai Cherating (Club Med)	4133903(B)	70.48	70.48	70.48	Moderate
		Pantai Cherating (Legend)	4133942 A)	75.73	75.73	70.02	Moderate
		Pantai Cherating (Legend)	4133942 B)	70.87	70.87	70.87	Moderate
		Pantai Muhibbah Balok	3933901(A)	52.06	52.06	51.16	Moderate
		Pantai Muhibbah Balok	3933901(B)	51.04	51.04	51.04	Moderate
		Pantai Batu Hitam	3833915(A)	71.20	71.20	69.36	Moderate
		Pantai Batu Hitam	3833915(B)	71.08	71.08	71.08	Moderate
		Pantai Berserah	3933941(A)	67.48	67.48	70.90	Moderate
		Pantai Berserah	3933941(B)	55.11	55.11	55.11	Moderate
		Pantai Teluk Cempedak	3833910(A)	67.99	67.99	64.29	Moderate
		Pantai Teluk Cempedak	3833910(B)	46.56	46.56	46.56	Poor
		Pantai Teluk Gelora	3833909(A)	52.24	52.24	50.21	Moderate
		Pantai Teluk Gelora	3833909(B)	50.49	50.49	50.49	Moderate
		Pantai Sepat	3737915	75.78	75.78	70.11	Moderate
		Pantai Sepat (B)	3633916	73.78	73.78	73.64	Moderate
		Pantai Legenda (A)	3534943(A)	64.74	64.74	70.92	Moderate
		Pantai Legenda (B)	3534943(B)	70.44	70.44	70.97	Moderate
		Pantai Kuala Api-Api	3235917	86.19	68.19	70.71	Moderate
		Pantai Tanjung Batu	3334915	58.64	58.64	70.50	Moderate
Terengganu	Coastal	Tioxide Utara (Kg. Bukit Kuang, Kijal)	4234950	82.06	86.37	70.52	Moderate
		Tioxide Tengah (Pupuk Semangat, Kijal)	4234951	88.85	88.57	70.32	Moderate
		Tioxide Selatan (KSB, T. Kalong)	4234952	88.10	88.02	69.60	Moderate
		Pantai Batu Buruk	5331935	64.50	53.47	57.66	Moderate
		Pantai Bukit Keluang	5825903	83.37	76.96	70.00	Moderate
		Pantai Chendering	5231934	90.36	57.99	51.76	Moderate
		Pantai Rantau Abang	4833917	77.98	85.50	70.11	Moderate
		KIPC Utara	4634954	88.10	83.71	50.19	Moderate
		KIPC Tengah	4534955	89.14	86.08	63.65	Moderate
		KIPC Selatan	4534956	90.06	83.63	51.70	Moderate
		Pulau Duyung	5231908	65.29	65.29	50.15	Moderate

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value			CATEGORY (2012)
				2010	2011	2012	
Kelantan	Coastal	Pantai Seri Tujuh	6221910	65.76	65.76	65.76	Moderate
		Pantai Cahaya Bulan	6122903	61.83	61.83	61.83	Moderate
		Pantai Sabak	6123909	63.46	63.46	63.46	Moderate
		Pantai Irama Bachok	6024908	70.50	70.50	70.50	Moderate
		Pantai Bisikan Bayu	5825905	62.00	62.00	62.00	Moderate
Sarawak	Coastal	Pantai Sematan	1898902	82.78	82.78	67.79	Moderate
		Pantai Pandan	1824918	69.36	85.21	60.43	Moderate
		Pantai Pasir Putih	1604910	89.97	70.33	69.60	Moderate
		Pantai Bako	1704906	90.22	78.38	73.63	Moderate
		Pantai Damai	1702904	74.26	73.06	70.20	Moderate
		Pantai Tanjung Kembang	1810923	69.44	69.44	70.40	Moderate
		Pantai Harmoni Mukah	2920921	50.30	50.30	69.90	Moderate
		Pantai Tanjung Batu	3132602	34.98	34.98	34.98	Poor
		Pantai Likau	3230915	48.22	48.22	48.22	Poor
		Pantai Emas	3331903	34.98	34.98	34.98	Poor
		Pantai Piasau	4539918	66.78	66.78	66.78	Moderate
		Pantai Brighton	4449917	57.31	57.31	52.45	Moderate
		Pantai Esplaned	4339920	53.47	53.47	53.47	Moderate
		Pantai Beraya	4238921	72.00	72.00	72.00	Moderate
		Pantai Bungai	4137922	72.35	72.35	72.35	Moderate
Sabah	Coastal	Pantai Teluk Brunei 1	5053901	71.54	72.36	72.36	Moderate
		Pantai Teluk Brunei 2	5053902	88.52	64.45	64.45	Moderate
		Pantai Teluk Brunei 3	5053903	88.14	72.96	72.95	Moderate
		Pantai Teluk Brunei 4	5053904	87.68	73.71	73.71	Moderate
		Pantai Teluk Brunei 5	5053905	84.53	75.38	75.38	Moderate
		Pantai Teluk Brunei 6	5053906	86.71	66.58	66.58	Moderate
		Borneo Golf Seawater	5355901	73.39	73.39	73.39	Moderate
		Pantai Manis Papar	5555901	85.29	85.29	85.29	Good
		Pantai Melinsung	5565902	84.09	84.09	84.09	Good
		Pantai Tanjung Aru (Rest Lido)	5656901	78.28	78.28	78.28	Moderate
		Pantai Tanjung Aru (Roll Skating)	5656902	74.49	74.49	74.49	Moderate
		Pantai Tanjung Aru (No. 3)	5656903	69.93	69.93	69.93	Moderate
		Pantai Lok Kawi	5656904	64.61	64.61	64.61	Moderate
		Pantai Dalit Tuaran	6161901	86.22	86.22	86.22	Good
		Mangrove Paradise	6161902	68.82	68.82	68.82	Moderate
		Pantai Sabandar	6161903	80.54	80.54	80.54	Good
		Pantai Bak-Bak Kudat	6665901	89.28	89.28	89.28	Good
		Pasir Putih Sandakan	5580901	85.12	85.12	85.12	Good
		Pantai TLDM	5580902	56.26	56.26	56.26	Moderate
		Pantai Batu Sapi	5580903	89.99	89.99	89.99	Good
		Pantai Ulu Tungku	5085901	88.17	88.17	88.17	Good
		Pantai Sarina Kunak	4481901	89.32	89.32	89.32	Good
		Pantai Kg. Lamak	4581902	89.01	89.01	89.01	Good
Pantai Tinagat	4473901	91.28	91.28	91.28	Excellent		

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value			CATEGORY (2012)
				2010	2011	2012	
Labuan	Coastal	Pulau Papan	5151905	56.00	49.12	65.11	Moderate
		Kiamsam	5151906	55.05	62.67	66.37	Moderate
		Sungai Pagar	5151907	55.81	48.21	66.10	Moderate
		Layang-Layangan	5251902	49.03	55.39	68.15	Moderate
		Tanjung Aru	5251903	56.31	61.99	65.93	Moderate

The trend in terms of Marine Water Quality Index (MWQI) for 2010 to 2012 is as shown in **Figure 4.1**. The number of excellent and good marine water quality stations had decreased, while the number of moderate stations had increased.

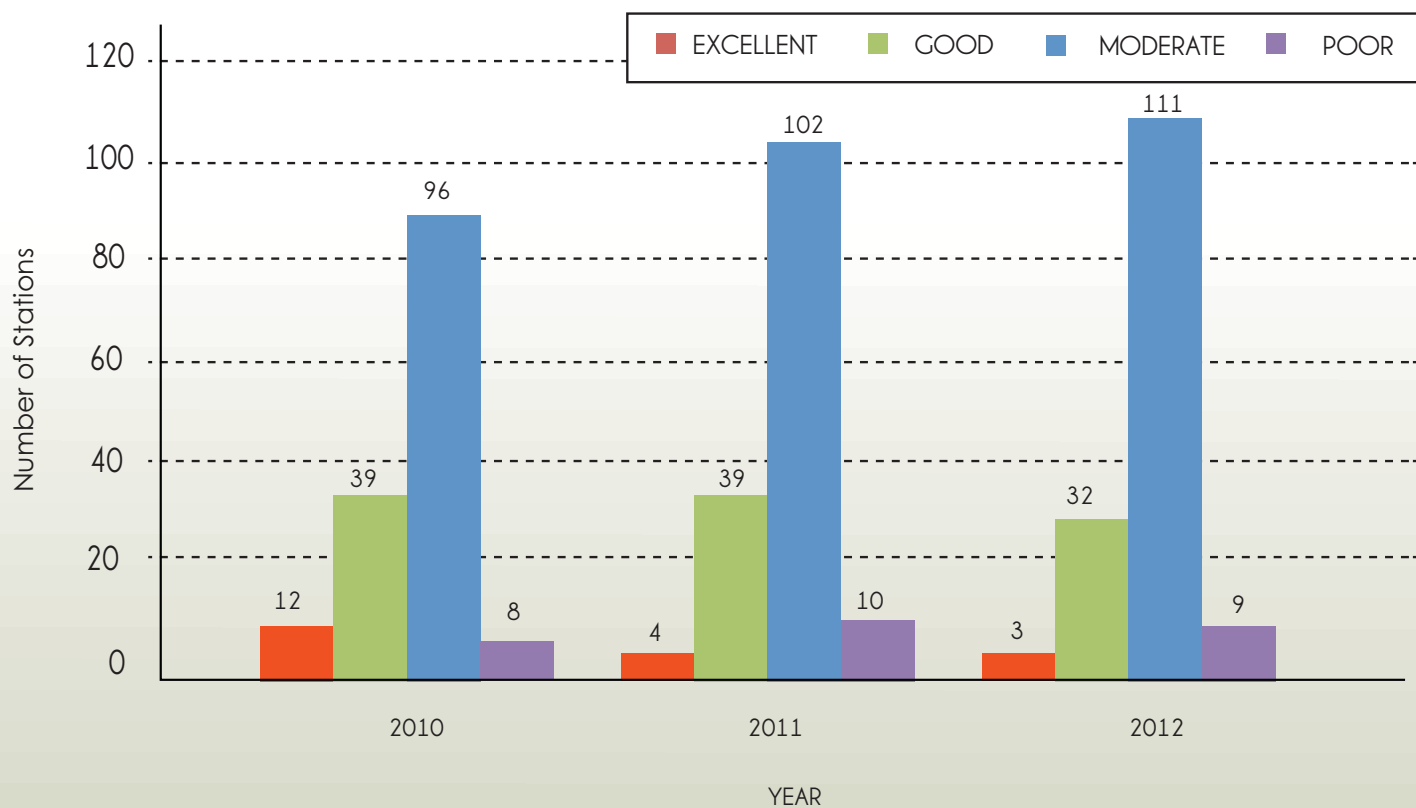


Figure 4.1 Malaysia: Marine Water Quality Index Trend for Coastal Area in Malaysia (2010-2012)

ESTUARY WATER QUALITY STATUS

Of the 78 estuary stations monitored in 2012, only 69 were analyzed for Marine Water Quality Index due to data availability. The result from the monitoring programme indicated one (1) station (1.4%) were categorized as excellent, eight (8) stations (11.6%) as good, 48 stations (69.6%) as moderate and 12 stations (17.4%) as poor. **(Table 4.4)**



Table 4.4 Malaysia: Marine Water Quality Index for Estuary Water Quality Status

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value			CATEGORY (2012)
				2010	2011	2012	
Perlis	Estuary	Kuala Sungai Baru Kuala Sungai Perlis	6201902	52.61	52.61	52.61	Moderate
			6401901	54.66	54.66	54.66	Moderate
Kedah	Estuary	Kuala Kedah Kuala Jerlun	6102908	65.38	65.38	65.38	Moderate
			6302925	65.38	65.38	65.38	Moderate
Pulau Pinang	Estuary	Kuala Sungai Jawi	5204901	62.60	57.37	61.04	Moderate
		Kuala Sungai Juru	5303904	66.31	49.58	60.11	Moderate
		Kuala Sungai Kerian	5104901	62.24	64.38	60.42	Moderate
		Kuala Sungai Pinang	5403934	10.85	62.90	60.49	Moderate
		Kuala Sungai Perai	5303908	10.38	49.39	55.11	Moderate
		Kuala Sungai Tengah	5204935	13.56	61.08	81.36	Good
		Kuala Sungai Pinang (BalikPulau)	5202929	50.43	50.43	48.51	Poor
Perak	Estuary	Kuala Sungai Manjung	4205930	89.28	89.28	33.36	Poor
		Kuala Sungai Gula	4906926	22.92	22.92	35.12	Poor
		Kuala Sungai Kurau	4994919	41.58	41.58	41.58	Poor
		Kuala Sungai Tanjung Piandang	5003921	40.24	38.67	38.67	Poor
		Kuala Sungai Sepetang	4806925	23.35	23.35	23.55	Poor
		Kuala Sungai Perak	4007901	66.49	66.49	46.34	Poor

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value			CATEGORY (2012)
				2010	2011	2012	
Selangor	Estuary	Kuala Sungai Sepang	2517922	81.79	81.79	87.09	Good
		Kuala Sungai Sepang (Kecil)	2612928	63.92	63.92	90.46	Excellent
		Kuala Sungai Sepang (Kawalan)	2616926	61.62	61.62	89.35	Good
		Kuala Sungai Langat (Jugra)	2814925	53.02	53.02	73.81	Moderate
		Kuala Sungai Klang	3013909	55.23	55.23	75.12	Moderate
		Kuala Sungai Langat (Lumut)	2913903	63.87	63.87	75.03	Moderate
		Kuala Sungai Buloh	3212930	66.52	66.52	74.69	Moderate
		Kuala Sungai Selangor	3312915	66.51	66.51	87.24	Good
		Kuala Sungai Tenggi	3311931	52.21	52.21	74.03	Moderate
		Kuala Sungai Bernam	3808924	66.32	66.32	88.52	Good
Negeri Sembilan	Estuary	Kuala Sungai Linggi	2319901	66.91	64.27	64.27	Moderate
		Kuala Sungai Lukut	2517910	60.01	67.94	67.94	Moderate
Melaka	Estuary	Kuala Sungai Melaka	2123903	54.52	49.89	56.78	Moderate
		Kuala Sungai Sri Melaka	2121914	48.65	48.65	56.51	Moderate
		Kuala Sungai Merlimau	2124912	55.11	64.06	47.57	Poor
		Kuala Sungai Kesang	2186905	62.24	67.08	61.71	Moderate
		Kuala Sungai Sebatu	2186904	55.32	62.82	54.16	Moderate
Johor	Estuary/ Straits	Kuala Sungai Segget	1437919	67.50	67.50	57.21	Moderate
		Kuala Sungai Skudai	1437922	68.16	68.16	61.32	Moderate
		Kuala Sungai Melayu	1437946	67.84	67.84	63.94	Moderate
		Kuala Sungai Tebrau	1438943	67.64	67.64	61.54	Moderate
		Kuala Sungai Kim-Kim	1439965	83.54	83.54	60.34	Moderate
	Estuary	Kuala Sungai Johor	1440916	91.60	91.60	59.45	Moderate
		Kuala Sungai Batu Pahat	1729930	62.99	62.99	82.33	Good
		Kuala Sungai Muar	2024932	62.63	62.63	82.37	Good
		Kuala Sungai Mersing	2438905	67.41	67.41	82.88	Good
Terengganu	Estuary	Kuala Sungai Besut	5825902	80.37	61.13	61.22	Moderate
		Kuala sungai Dungun	4734918	84.47	53.15	51.70	Moderate
		Kuala Sungai Ibai	5231949	66.18	53.31	52.08	Moderate
		Kuala Sungai Kerteh	4534922	68.95	74.31	57.50	Moderate
		Kuala Sungai Marang	5232911	68.95	71.49	57.59	Moderate
		Kuala Sungai Paka	4634920	64.52	80.99	62.71	Moderate
		Kuala Sungai Setiu	5627953	87.63	49.83	56.41	Moderate
		Kuala Sungai Terengganu	5331907	76.48	58.42	51.06	Moderate
		Kuala Sungai Kemaman/Chukai	4234929	29.02	82.32	49.76	Poor
Kelantan	Estuary	Kuala Sungai Golok	6220911	56.01	56.01	56.01	Moderate
		Kuala Sungai Kelantan	6222901	45.08	45.08	45.08	Poor
		Kuala Sungai Pengkalan Chepa	6223912	48.16	48.16	48.16	Poor
		Kuala Sungai Pengkalan Datu	6123913	59.05	59.05	59.05	Moderate
		Kuala Sungai Kemasin	5824914	59.36	59.36	59.36	Moderate

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value			CATEGORY (2012)
				2010	2011	2012	
Sarawak	Estuary	Kuala Sungai Semantan	1898901	92.92	79.45	72.01	Moderate
		Kuala Sungai Sarawak	1604907	88.03	61.59	67.11	Moderate
		Kuala Sungai Bako	1704905	94.26	59.67	55.69	Moderate
		Kuala Sungai Santubong	1702903	94.03	86.81	70.00	Moderate
		Kuala Batang Krian (Kabong)	1710922	70.39	70.39	70.39	Moderate
		Kuala Batang Rejang	2111909	70.81	70.81	70.81	Moderate
		Kuala Pantai Belawai	2212913	54.17	54.17	52.44	Moderate
		Kuala Mukah	2920920	59.31	59.31	59.31	Moderate
		Kuala Batang Kemena	3130911	56.56	56.56	56.56	Moderate
		Kuala Tanjung Similajau	3431903	41.75	41.75	41.75	Poor
Sabah	Estuary	Kuala Penyu	5453901	31.60	55.42	55.42	Moderate
		Muara Sungai Inanam	5050905	58.76	58.76	58.76	Moderate



The Estuarine water quality in terms of Marine Water Quality Index (MWQI), had shown a slight improvement for the good category as the good stations had increased from 8.7% in 2011 to 11.6% in 2012. There were also some decrements from 50 stations in 2011 to 48 stations in 2012 for moderate stations, while excellent stations and poor stations remains the same for 2011 and 2012. These trends are shown in **Figure 4.2**.



Figure 4.2 Malaysia: Marine Water Quality Index Trend for Estuary Area (2010-2012)

ISLAND MARINE WATER QUALITY STATUS

Table 4.5 Malaysia: List of Island Stations by Category, 2012

STATE	NO.OF ISLAND	NO.OF STATION	MONITORING STATION SITE	STATION NO	CATEGORY
KEDAH	7	4	LANGKAWI (PANTAI KUAH)	7KD07	DEVELOPMENT
			LANGKAWI (TELUK EWA)	7KD08	
			LANGKAWI (PANTAI CHENANG)	7KD09	
			LANGKAWI (TANJUNG RHU)	7KD10	
		1	SINGA BESAR	7KR01	RESORT
		1	DAYANG BUNTING	7KR02	
		1	PAYAR	7KM03	MARINE PARK
		1	KACA	7KM04	
1	LEMBU	7KM05			
1	SIGANTANG	7KM06			
PULAU PINANG	6	4	PULAU PINANG (BATU MAUNG)	7PD01	DEVELOPMENT
			PULAU PINANG (GERTAK SANGGUL)	7PD02	
			PULAU PINANG (TELUK BAHANG)	7PD03	
			PULAU PINANG (PADANG KOTA)	7PD04	
		1	AMAN	7PR05	RESORT
		1	JEREJAK	7PR06	
		1	KENDI	7PR07	
		1	RIMAU	7PR08	
		1	GEDONG	7PR09	
PERAK	4	2	PANGKOR (TELOK GEDONG)	7AR01	RESORT
			PANGKOR(PANTAI PUTERI DEWI)	7AR02	
		1	PANGKOR LAUT	7AR03	PROTECTED
		1	SEMBILAN	7AR04	
		1	TUKUN PERAK	7AP05	
SELANGOR	3	1	KETAM	7BR01	RESORT
		1	ANGSA	7BR02	
		1	LUMUT	7BR03	
NEGERI SEMBILAN	1	1	PULAU ARANG	7NP01	PROTECTED
MELAKA	3	2	BESAR	7MR01	RESORT
		2	UPEH	7MR02	
		2	UNDAN	7MR03	

STATE	NO.OF ISLAND	NO.OF STATION	MONITORING STATION SITE	STATION NO	CATEGORY		
JOHOR	8	1	SETINDAN	7JR01	RESORT		
		1	BABI TENGAH	7JR02			
		1	DAYANG	7JM03	MARINE PARK		
		1	NANGA BESAR	7JM08			
		1	SIBU TENGAH	7JM11			
		1	PEMANGGIL	7JM15			
				1	KUKUP	7JP17	PROTECTED
				1	PISANG	7JP18	
PAHANG	8	2	TIOMAN (TELOK SALANG)	7CM01	MARINE PARK		
			TIOMAN (KG NIPAH)	7CM01			
		1	SERI BUAT	7CM03			
		1	CEBEH	7CM04			
		1	TULAI	7CM05			
		1	SEPUI	7CM06			
		1	LABAS	7CM07			
		1	SEMBILANG	7CM08			
		1	TOKONG BAHARA	7CM09			
TERENGGANU	10	2	PERHENTIAN BESAR (SOUTH)	7TM04	MARINE PARK		
			PERHENTIAN BESAR (WEST)	7TM05			
		1	PERHENTIAN KECIL	7TM06			
		2	REDANG (NORTH)	7TM07			
			REDANG (SOUTH)	7TM08			
		1	KAPAS	7TM09			
		1	LANG TENGAH	7TM11			
		1	PINANG	7TM12			
		1	EKOR TEBU	7TM13			
		1	LIMA	7TM14			
		1	GEMIA	7TR01	RESORT		
		1	BIDONG LAUT	7TR02			
KELANTAN	2	1	PANJANG	7DP01	PROTECTED		
		1	KUNDUR	7DP02			

STATE	NO.OF ISLAND	NO.OF STATION	MONITORING STATION SITE	STATION NO	CATEGORY
SARAWAK	3	1	SATANG	7QP01	PROTECTED
		1	TALANG-TALANG KECIL	7QP02	
		1	TALANG-TALANG BESAR	7QP03	
SABAH	17	1	GAYA	7SR01	RESORT
		1	MABUL	7SR03	
		2	SIPADAN (NORTH)	7SR04	
			SIPADAN (WEST)	7SR05	
		1	SAPI	7SM08	MARINE PARK
		1	MANUKAN	7SR09	RESORT
		1	TIGA	7SR10	
		1	KALAMPUNIAN BESAR	7SM11	MARINE PARK
		1	KAPALAI	7SR12	RESORT
		1	LIGITAN	7SR13	
		1	MOLLEANGAN BESAR	7SR14	
		1	BANGGI	7SR15	
		1	BALAMBANGAN	7SR16	PROTECTED
		1	SILINGAN	7SP17	
		1	GULISAN	7SP18	
		1	BAKUNGAN KECIL	7SP19	RESORT
		1	BANGGI	7SR20	
1	MANTANANI BESAR	7SR21			
LABUAN	4	4	LABUAN (POHON BATU)	7LD01	DEVELOPMENT
			LABUAN (WATER FRONT)	7LD02	
			LABUAN (LUBUK TEMIANG)	7LD03	
			LABUAN (RANCHA-RANCHA)	7LD04	
		1	KURAMAN	7LM05	MARINE PARK
		1	RUSUKAN BESAR	7LM06	
		1	RUSUKAN KECIL	7LM07	

The waters around 76 islands were monitored in 2012. The islands monitored include development islands (3 islands), resort islands (32 islands), marine park islands (29 islands) and protected islands (12 islands).

From all the 93 island stations only 86 were analysed for the Marine Water Quality Index based on data availability. The result indicated that 13 stations (15.1%) were categorized as excellent, 18 stations (20.9%) as good, 52 stations (60.5%) as moderate and only three (3) stations (3.5%) as poor. **(Figure 4.3).**

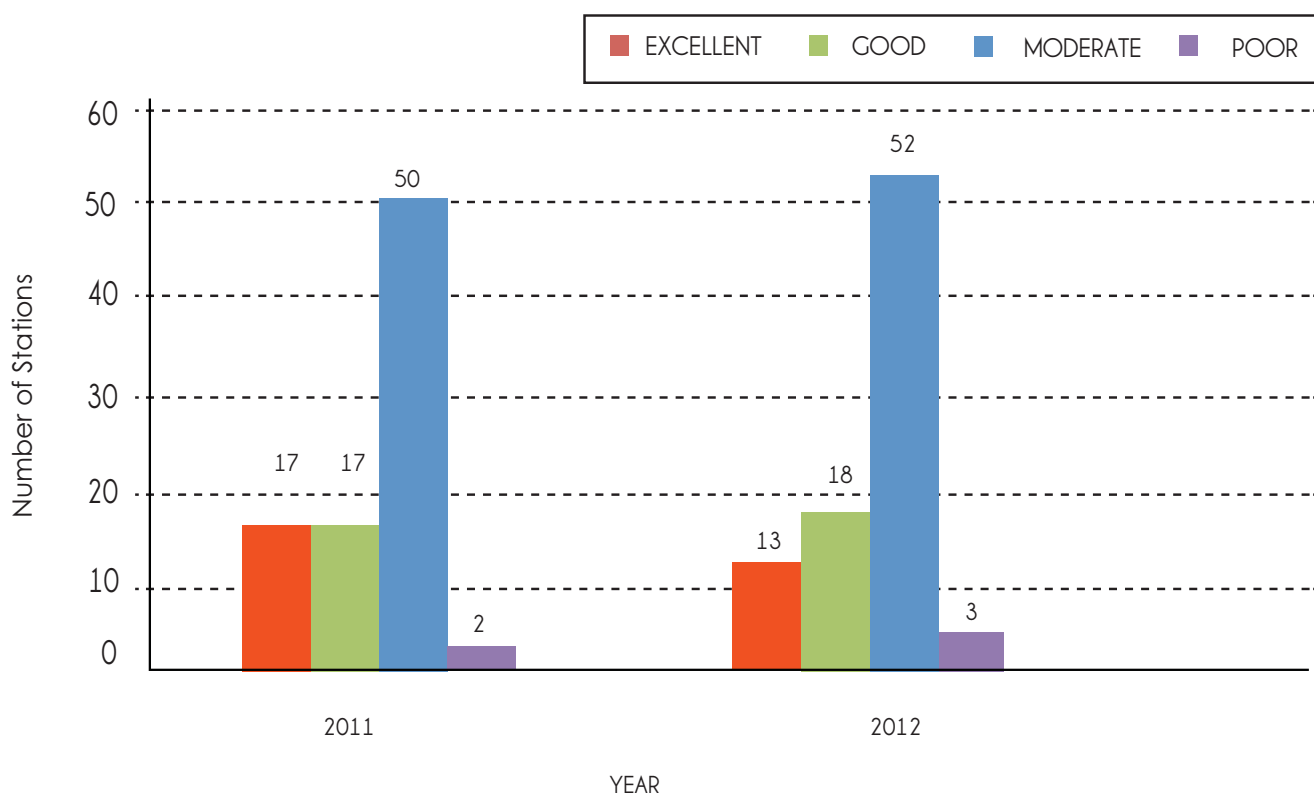


Figure 4.3 Malaysia: Marine Water Quality Index Trend for Island (2011-2012)

Table 4.6 Malaysia: Marine Water Quality Index for Island Marine Water Quality Status

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value		CATEGORY (2012)
				2011	2012	
Kedah	Island	Singa Besar	7KR01	72.54	79.56	Moderate
		Dayang Bunting	7KR02	68.99	27.51	Poor
		Payar	7KM03	81.67	81.67	Good
		Kaca	7KM04	81.67	81.67	Good
		Pantai Kuah	7KD07	63.95	73.88	Moderate
		Pantai Chenang	7KD08	74.63	87.61	Good
		Tanjung Rhu	7KD09	78.74	94.68	Excellent
		Teluk Ewa	7KD10	74.88	73.36	Moderate

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value		CATEGORY (2012)
				2011	2012	
Pulau Pinang	Island	Batu Maung	7PD01	95.58	76.78	Moderate
		Padang Kota	7PD04	96.00	54.29	Moderate
		Aman	7PR05	63.01	63.01	Moderate
		Jerejak	7PR06	64.88	64.88	Moderate
		Kendi	7PR07	86.35	86.35	Good
		Rimau	7PR08	89.88	89.88	Good
		Gedong	7PR09	67.21	67.21	Moderate
Perak	Island	Pantai Teluk Gedong	7AR01	87.21	73.35	Moderate
		Pantai Puteri Dewi	7AR02	78.34	83.00	Good
		Pangkor Laut	7AR03	85.62	68.44	Moderate
		Sembilan	7AR04	54.44	69.63	Moderate
		Tukun Perak	7AP05	94.18	68.69	Moderate
Selangor	Island	Ketam	7BR01	80.16	88.92	Good
		Angsa	7BR02	91.18	84.89	Good
		LumuT	7BR03	39.93	84.89	Good
Negeri Sembilan	Island	Arang	7NP01	81.24	81.24	Good
Melaka	Island	Upeh (Point A)	7MR02	51.52	38.05	Poor
		Upeh (Point B)	7MR02	61.00	54.88	Moderate
		Besar (Point A)	7MR01	75.70	72.07	Moderate
		Besar (Point B)	7MR01	65.99	66.67	Moderate
		Undan (Point A)	7MP03	76.02	80.44	Good
		Undan (Point B)	7MP03	51.22	68.95	Moderate
Johor	Island	Setindan	7JR01	94.57	96.10	Excellent
		Babi Tengah	7JR02	97.00	96.20	Excellent
		Dayang	7JM03	96.37	95.98	Excellent
		Nanga Besar	7JM08	96.56	95.80	Excellent
		Sibu Tengah	7JM11	96.96	94.85	Excellent
		Pemanggil	7JM15	96.90	96.63	Excellent
		Kukup	7JP17	75.78	90.43	Excellent
		Pisang	7JP18	80.64	93.45	Excellent
Pahang	Island	Tioman (Teluk Salang)	7CM01	97.75	61.15	Moderate
		Tioman (Kg. Nipah)	7CM01	97.85	61.35	Moderate
		Tulai	7CM05	97.91	61.52	Moderate
		Labas	7CM07	97.91	61.64	Moderate
		Cebah	7CM04	97.86	53.38	Moderate
		Sepui	7CM08	97.86	58.86	Moderate
		Sembilang	7CM08	97.87	55.26	Moderate
		Seri Buat	7CM03	97.97	56.05	Moderate
		Tokong Bahara	7CM09	50.12	50.12	Moderate

STATE	STATION CLASSIFICATION	AREA	STATION NUMBER	MWQI Value		CATEGORY (2012)			
				2011	2012				
Terengganu	Island	Gemia	7TR01		81.96	77.43	Moderate		
		Perhentian Besar (South)	7TM04		32.69	68.70	Moderate		
		Perhentian Besar (West)	7TM05		55.87	71.08	Moderate		
		Perhentian Kecil	7TM06		59.55	71.68	Moderate		
		Redang	7TM06		71.77	66.91	Moderate		
		Lang Tengah	7TM11		87.63	70.44	Moderate		
		Pinang	7TM12		88.56	62.99	Moderate		
		EkorTebu	7TM13		73.82	62.83	Moderate		
		Lima	7TM14		68.38	69.85	Moderate		
		Kapas	7TP16		88.14	68.50	Moderate		
		Redang (South)	7TM08		65.48	65.48	Moderate		
		Kelantan	Island	Panjang	7DP01		76.01	62.79	Moderate
Kundur	7DP02				82.47	61.16	Moderate		
Sarawak	Island	Satang	7QP01		61.21	92.00	Excellent		
		Talang-Talang Kecil	7QP02		58.71	92.17	Excellent		
		Talang-Talang Besar	7QP03		78.87	92.58	Excellent		
Sabah	Island	Gaya	7SR01		80.56	80.56	Good		
		Mabul	7SR03		70.17	70.17	Moderate		
		Sipadan(N)	7SR04		66.01	66.01	Moderate		
		Sipadan(W)	7SR05		70.55	70.55	Moderate		
		Sapi	7SM08		81.51	81.51	Good		
		Manukan	7SM09		76.35	76.35	Moderate		
		Tiga	7SR10		69.73	69.73	Moderate		
		Kalampunian Besar	7SM11		64.74	64.74	Moderate		
		Kapalai	7SR12		69.74	69.74	Moderate		
		Ligitan	7SR13		70.60	70.60	Moderate		
		Molleangan Besar	7SR14		54.93	54.93	Moderate		
		Banggi	7SR15		60.59	60.59	Moderate		
		Banggi	7SR20		55.57	55.57	Moderate		
		Balambangan	7SR16		80.08	80.08	Good		
		Selingan	7SP17		64.77	64.77	Moderate		
		Gulisan	7SP18		67.76	67.76	Moderate		
		Bakungan Kecil	7SP19		64.19	64.19	Moderate		
		Labuan	Island	Kuraman	7LM05		60.23	83.10	Good
				Rusukan Besar	7LM07		62.15	85.26	Good
Rusukan Kecil	7LM06				63.35	86.21	Good		
Pohon Batu	7LD01				66.08	90.71	Excellent		
Water Front	7LD02				56.90	71.80	Moderate		
Lubuk Temiang	7LD03				63.45	86.23	Good		
Ranca-Ranca	7LD04				63.15	86.19	Good		

STATUS OF MARINE WATER QUALITY

Table 4.7 and **Table 4.8** show the list of coastal and estuaries stations that achieve the Excellent Category for Malaysia Marine Water Quality Index in 2012.

Table 4.7 Malaysia: 10 Excellent Estuaries Monitoring Stations, 2012

STATE	LOCATION
SELANGOR	KUALA SUNGAI SEPANG (KECIL)
SELANGOR	KUALA SUNGAI SEPANG (KAWALAN)
SELANGOR	KUALA SUNGAI BERNAM
SELANGOR	KUALA SUNGAI SELANGOR
SELANGOR	KUALA SUNGAI SEPANG
JOHOR	KUALA SUNGAI MERSING
JOHOR	KUALA SUNGAI MUAR
JOHOR	KUALA SUNGAI BATU PAHAT
PULAU PINANG	KUALA SUNGAI TENGAH
SELANGOR	KUALA SUNGAI KLANG

Table 4.8 Malaysia: 10 Excellent Coastal Monitoring Stations, 2012

STATE	LOCATION
SELANGOR	SELAT PULAU BABI
SELANGOR	PANTAI BAGAN LALANG
JOHOR	TANJUNG BIN
JOHOR	JETI KUKUP
JOHOR	PELABUHAN TANJUNG PELEPAS
JOHOR	PANTAI DESARU
JOHOR	TANJUNG SEPANG
JOHOR	TANJUNG BUAI
JOHOR	JETI TANJONG BELUNGKOR
JOHOR	PASIR GOGOK

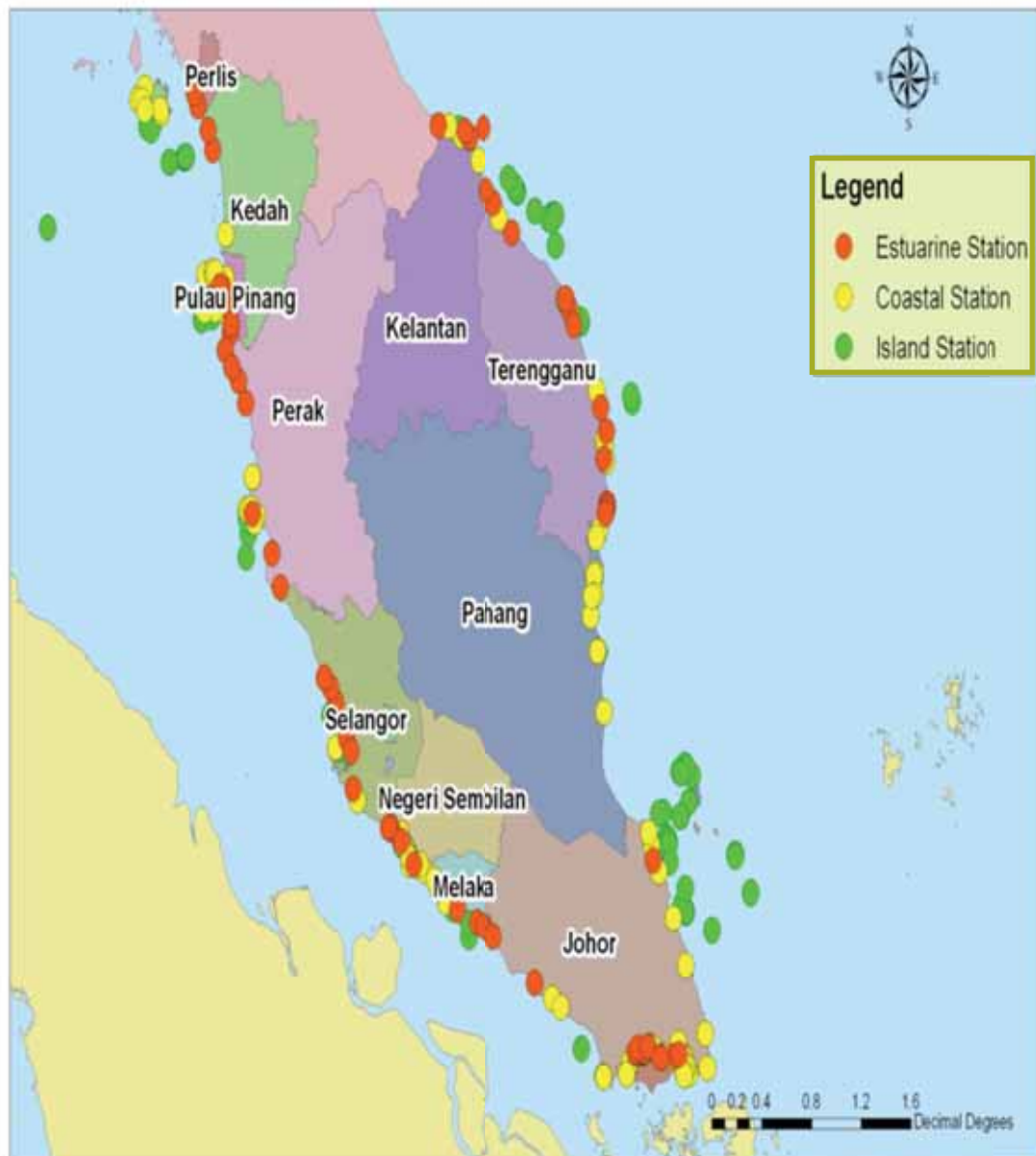
The islands that achieve the Excellent Category for Marine Water Quality Index in 2012 are listed in **Table 4.9**.

Table 4.9 Malaysia: 10 Excellent Islands Monitoring Stations, 2012

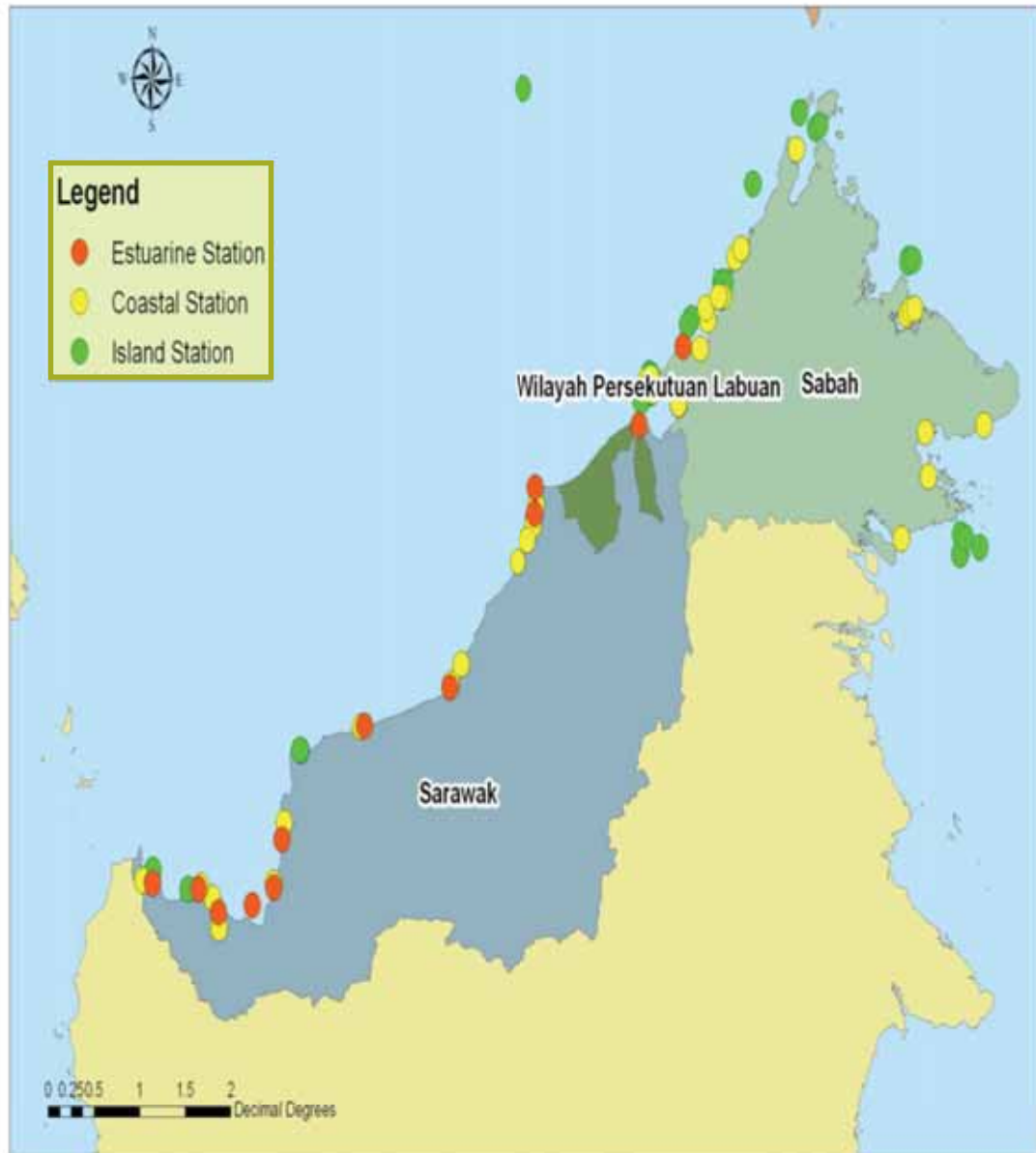
RANK	STATE	ISLAND	ISLAND CATEGORY
1	JOHOR	PEMANGGIL	MARINE PARK
2	JOHOR	BABI TENGAH	RESORT
3	JOHOR	SETINDAN	RESORT
4	JOHOR	DAYANG	MARINE PARK
5	JOHOR	NANGA BESAR	MARINE PARK
6	KEDAH	PULAU LANGKAWI (TANJUNG RHU)	DEVELOPMENT
7	JOHOR	SIBU TENGAH	MARINE PARK
8	JOHOR	PISANG	PROTECTED
9	SARAWAK	TALANG-TALANG BESAR	PROTECTED
10	SARAWAK	TALANG-TALANG KECIL	PROTECTED

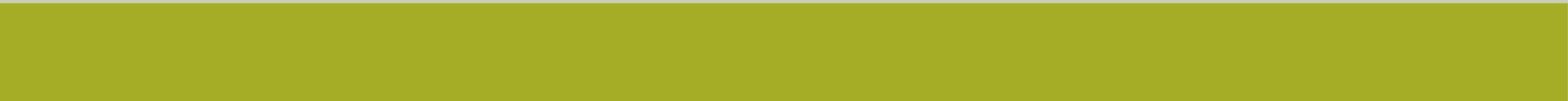


Map 4.1 Malaysia : Location of Marine Water Quality Stations



Map 4.2 Malaysia : Location of Marine Water Quality Stations





CHAPTER 5



POLLUTION SOURCES INVENTORY

WATER POLLUTION SOURCES

The sources of water pollution can be categorized as point sources and non point sources. Point sources of pollution are referred to the sources with discharges entering water body at specific location such as from pipes or outfalls. Point sources include the discharges from industries, sewage treatment plants and animal farms. Non point sources are diffuse sources and do not have specific discharge point such as agricultural activities and surface run-off.

In 2012, 1,662,329 water pollution point sources were identified. These sources comprised of 4,595 manufacturing industries, 9,883 sewage treatment plants (not including Individual Septic Tank (IST) and Communal Septic Tank (CST)), 754 animal farm (pig farming), 508 agro-based industries, 865 wet markets and 192,710 food services establishments.

The distribution of pollution sources by sector in Malaysia is as shown in **Table 5.1**

Table 5.1 Malaysia : Composition of Water Pollution Sources by Sector, 2012

NO	Type of sources	No.of sources
1	Manufacturing Industries	4,595
2	Agro-based Industries	
	a) Rubber Mill	72
	b) Palm Oil Mill	436
3	Animal farm (Pig farming)	754
4	Sewage treatment plant@	
	Public	5,800
	Private	4,083
	Individual Septic Tank (IST) #	1,449,383
	Communal Septic Tank (CST) #	3,631
5	Food Services Establishments*	192,710
6	Wet markets"	865
	Total	1,662,329

Sources of information:-

* The number of restaurants/ food stalls/ caterers registered in Food Safety Information System for Malaysia - Domestic (FoSIM) under Ministry of Health Malaysia and Local Government Department

Excluded Sabah & Sarawak

@ Indah Water Konsortium

" Local Government Department

^ Department of Veterinary Services

POLLUTION LOAD

There were three (3) parameters of pollutant loading that have significant impact on the river water quality namely Biological Oxygen Demand (BOD), Suspended Solids (SS) and Ammoniacal Nitrogen (AN). The BOD₅, SS and AN loadings by pollution sources were shown below.

BIOLOGICAL OXYGEN DEMAND LOAD

The estimated Biochemical Oxygen Demand (BOD) load in 2012 was 848 tonnes/day which had decreased by 39% compared to 2011 (1,394 tonnes/day). Data load for sewage in year 2012 was calculated based on actual discharges. Sewage remained the largest contributor with a total load of 294 tonnes/day (34.7%), followed by animal farm (pig farming) 229 tonnes/day (27%), food services establishments 200 tonnes/day (23.5%), agro-based industries 89 tonnes/day (10.5%), manufacturing Industries 30 tonnes/day (3.6%) and wet markets 6 tonnes/day (0.7%) as shown in **Figure 5.1**.

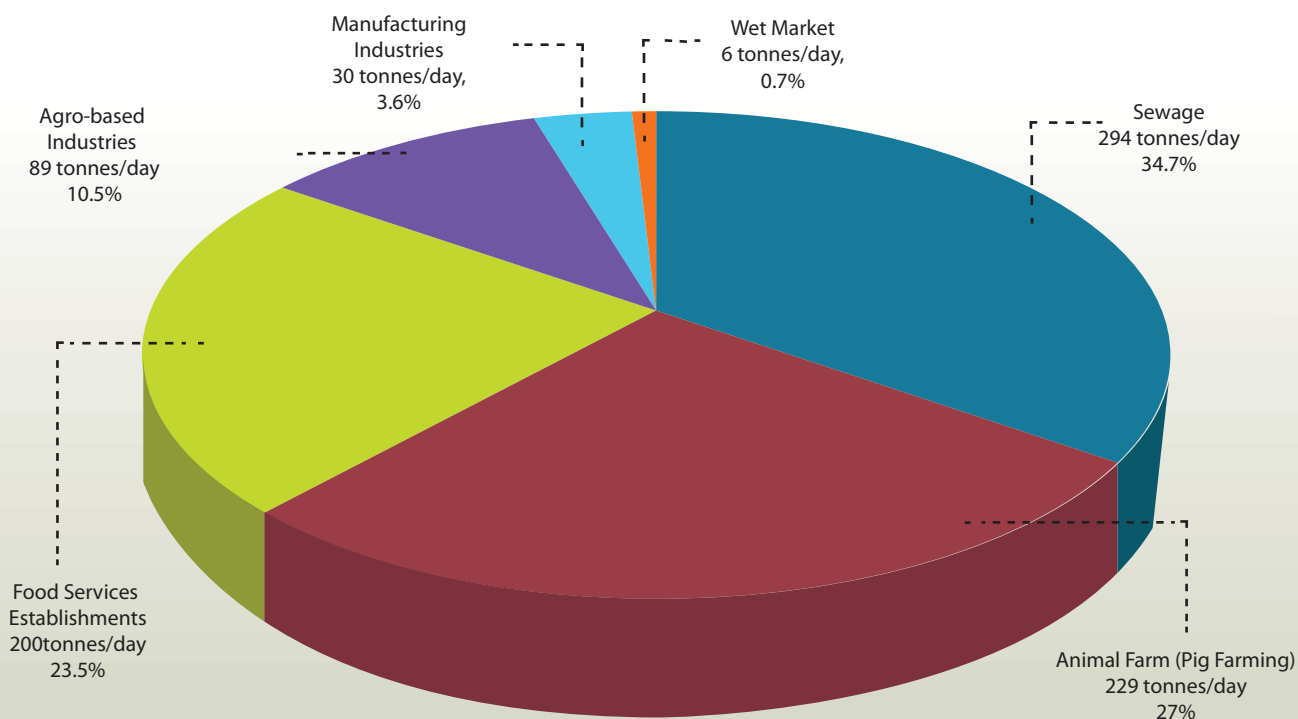


Figure 5.1 Malaysia : BOD Loading by Water Pollution Sources , 2012

SUSPENDED SOLIDS LOAD

The estimated Suspended Solids (SS) load in 2012 was 1383 tonnes/day where sewage was the largest contributor with a total load of 516 tonnes/day (37%), followed by animal farm (pig farming) 476 tonnes/day (34%), food services establishments 239 tonnes/day (17%), agro-based industries 78 tonnes/day (6%), manufacturing Industries 66 tonnes/day (5%) and wet market 8 tonnes/day (1%) as shown in **Figure 5.2**.

AMMONIACAL NITROGEN LOAD

The estimated Ammoniacal Nitrogen (AN) load in 2012 was 232 tonnes/day where sewage was the largest contributor with a total load of 175 tonnes/day (75%), followed by animal farm (pig farming) 28 tonnes/day (12%), agro-based industries 20 tonnes/day (9%), food services establishments 8 tonnes/day (3.5%), manufacturing industries 1 tonne/day (0.4%) and wet market 0.3 tonne/day (0.1%) as shown in **Figure 5.3**.

Compared to other river basins in the country, Klang River Basin (Federal Territory of Kuala Lumpur and State of Selangor) received the highest BOD Load (142 tonnes/day), followed by Perak River Basin (State of Perak) 114 tonnes/day, Sarawak River Basin (State of Sarawak) 30 tonnes/day, Jawi River Basin (State of Pulau Pinang) 26 tonnes/day and Muar River Basin (State of Johor) 24 tonnes/day. The BOD loading of top ten river basins is as shown in **Figure 5.4**. The BOD load for the rest of the river basins was estimated to be less than 21 tonnes/day.

The Klang River Basin still received the highest SS Load (360 tonnes/day), followed by Perak River Basin 181 tonnes/day, Jawi River Basin 51 tonnes/day, Sarawak River Basin 49 tonnes/day and Prai River Basin (State of Pulau Pinang) 35 tonnes/day. The SS loading for the same ten river basins is as shown in **Figure 5.5**. The SS load for the rest of the river basins was estimated to be less than 30 tonnes/day.

The Klang River Basin received the highest AN Load (37 tonnes/day), followed by Perak River Basin 15 tonnes/day, Melaka River Basin 9 tonnes/day, Linggi River Basin 5 ton/day and Pahang River Basin 4.8 tonnes/day. The AN loading for the same ten river basins is as shown in **Figure 5.6**. The AN load for the rest of the river basins was estimated to be less than 4.8 tonnes/day.



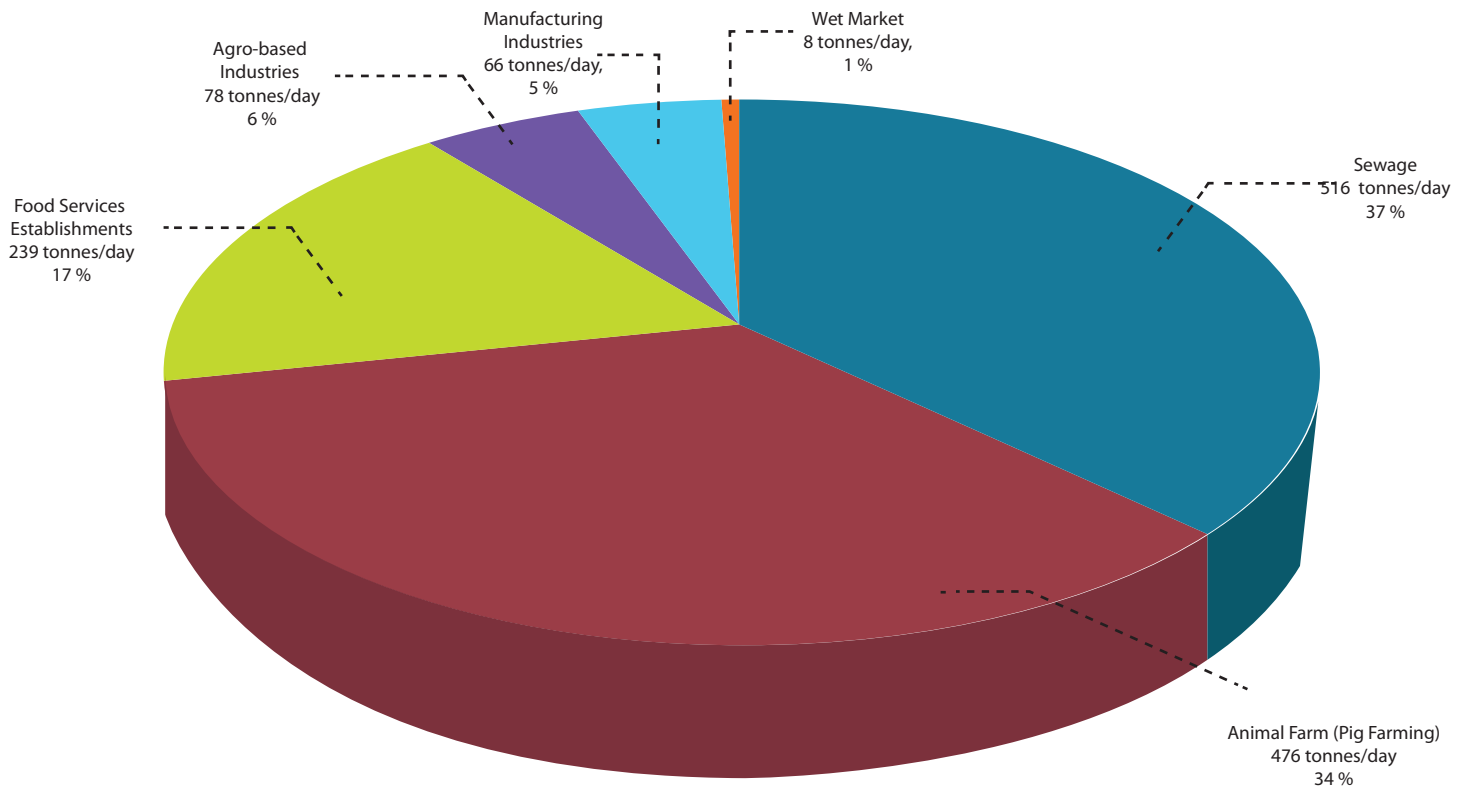


Figure 5.2 Malaysia : SS Loading by Water Pollution Sources , 2012

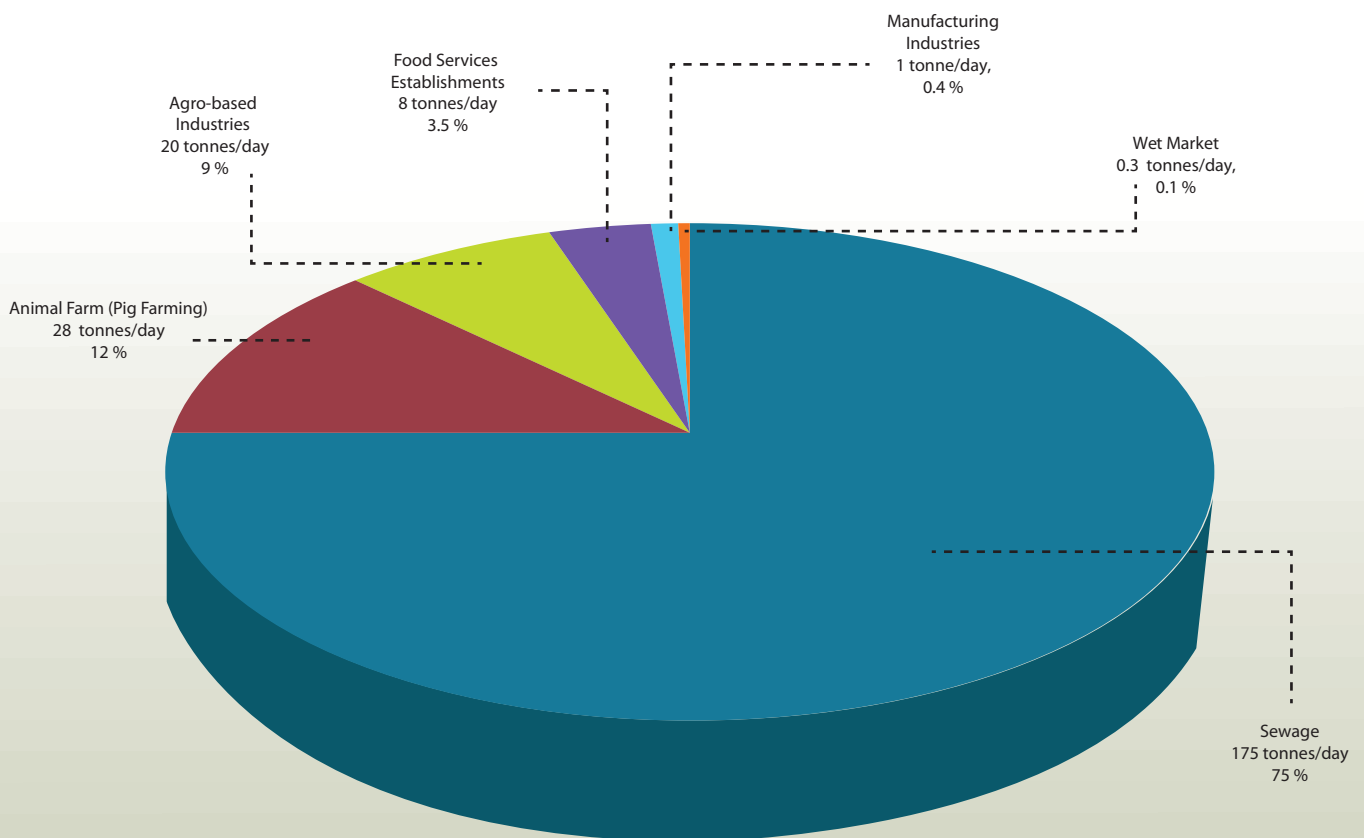


Figure 5.3 Malaysia : AN Loading by Water Pollution Sources , 2012

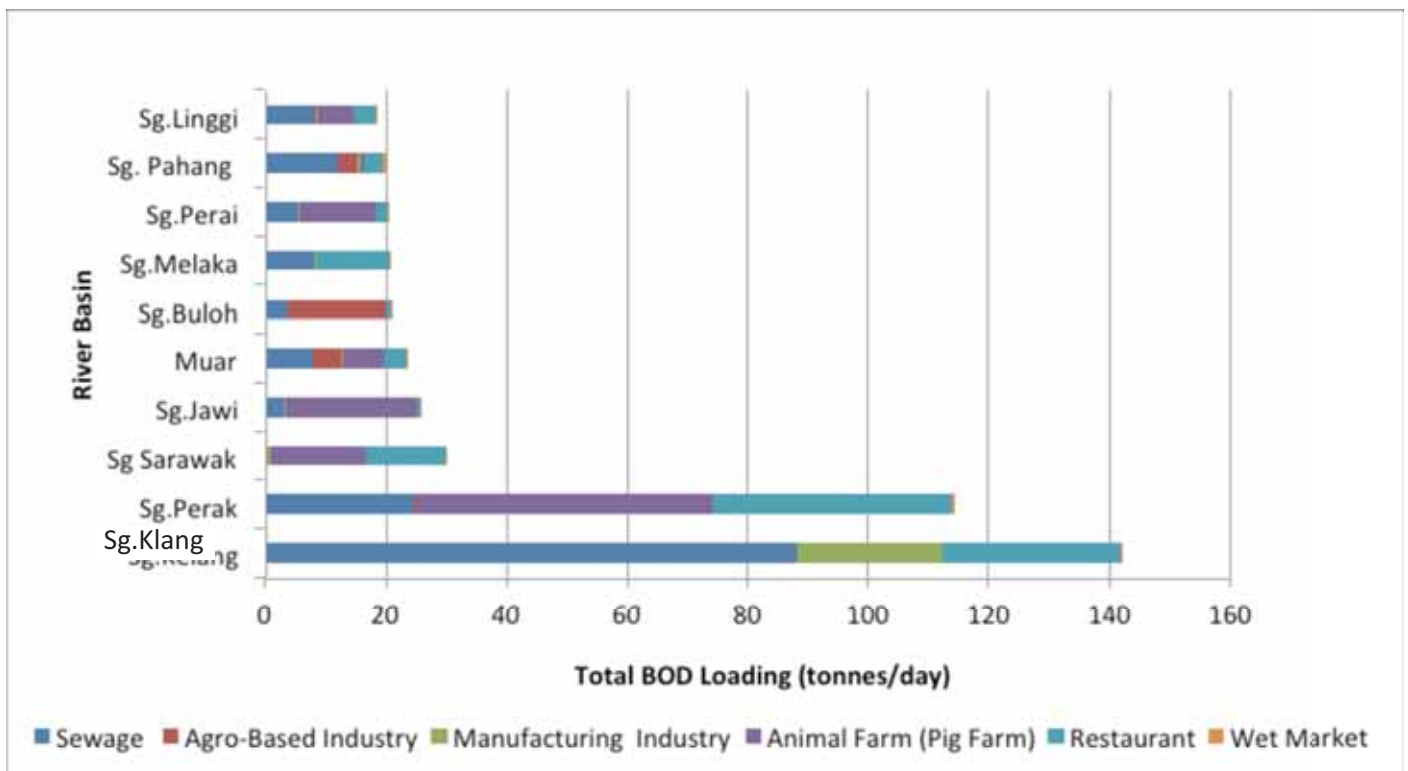


Figure 5.4 Malaysia : Distribution of BOD load by river basin and water pollution sources, 2012

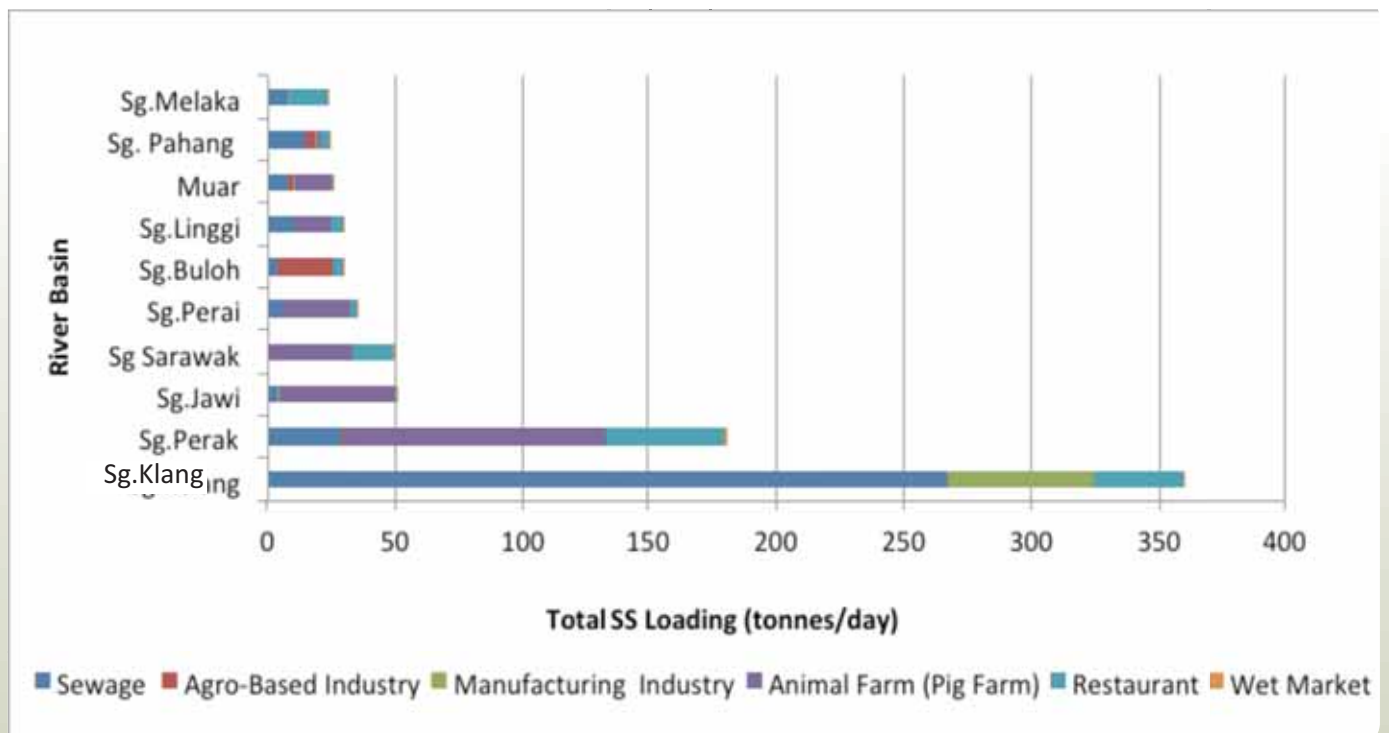


Figure 5.5 Malaysia : Distribution of SS load by river basin and water pollution sources, 2012

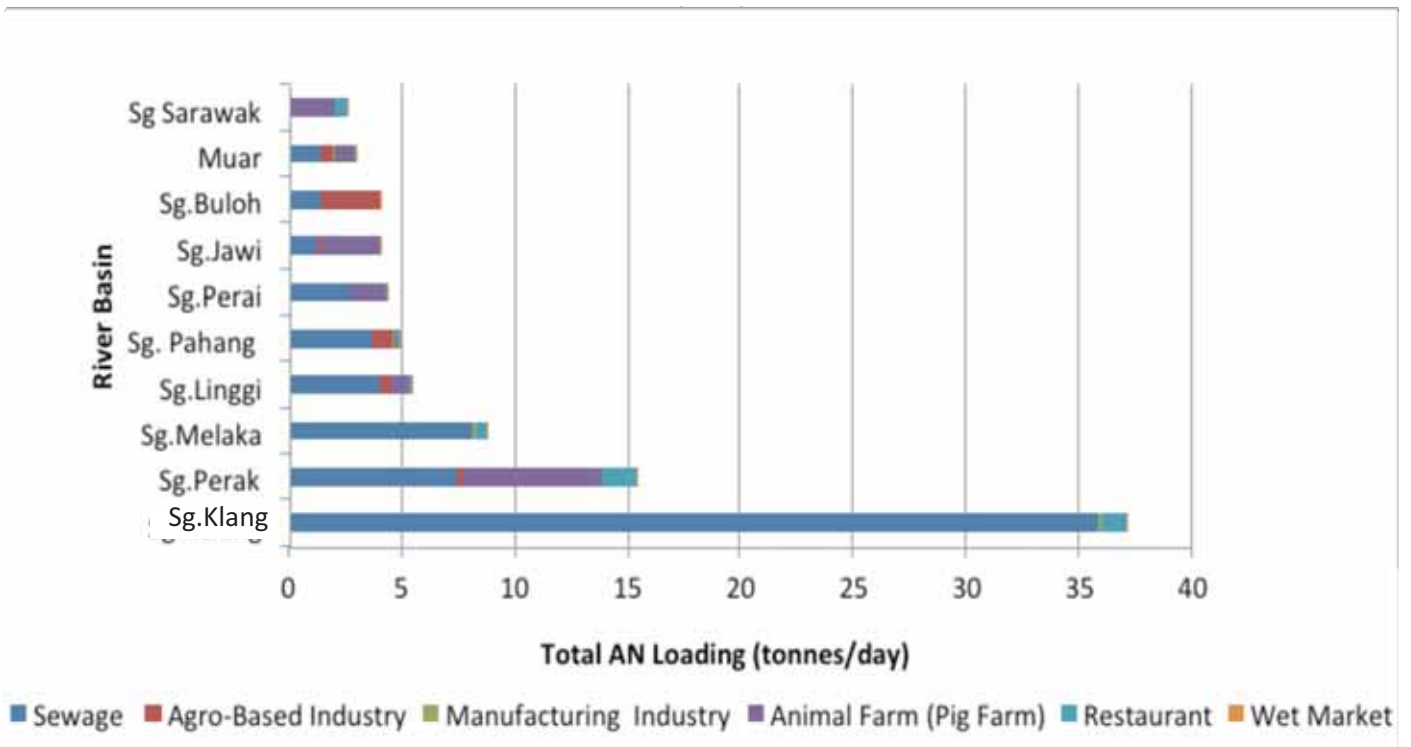
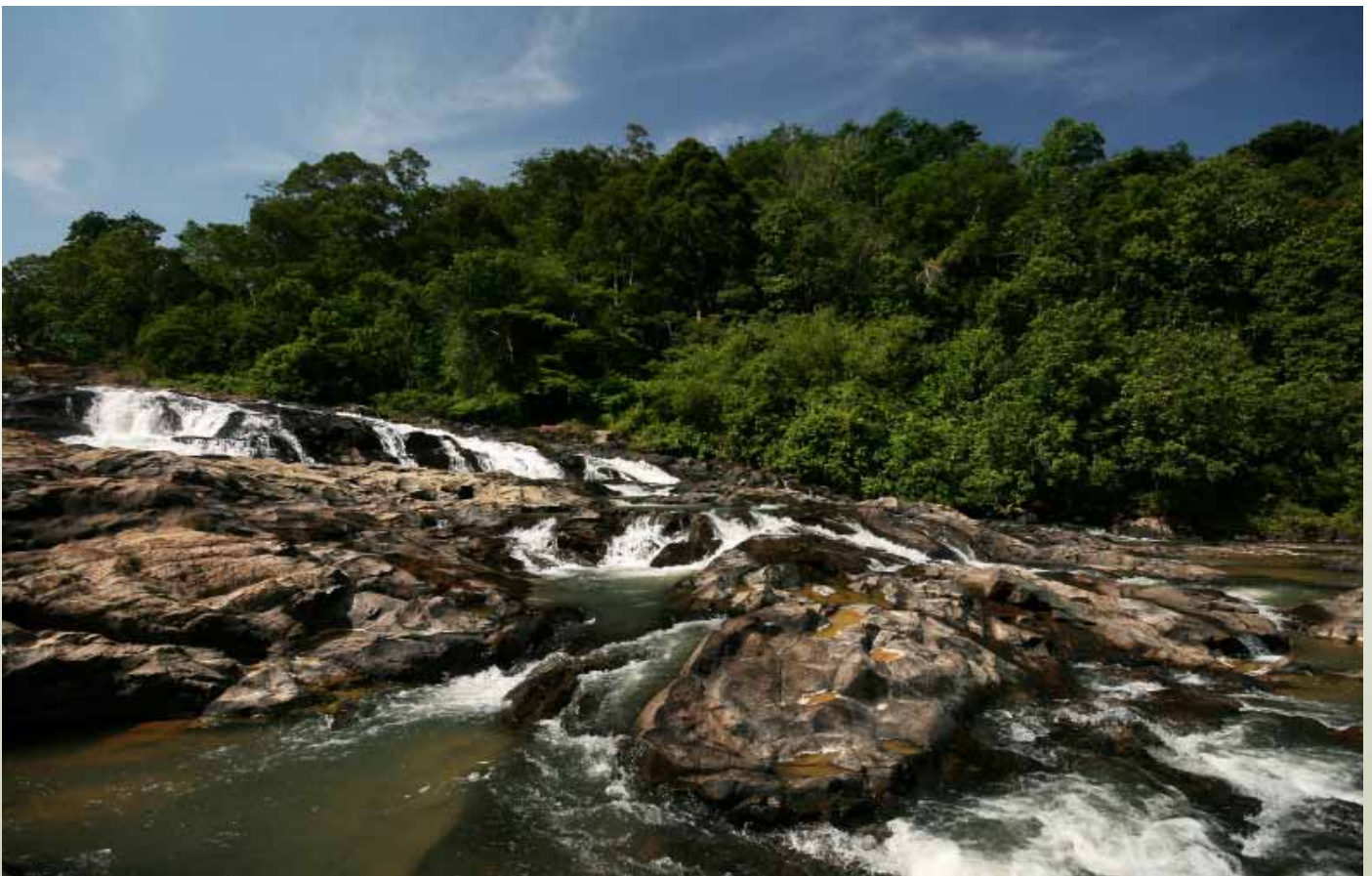


Figure 5.6 Malaysia : Distribution of AN load by river basin and water pollution sources, 2012

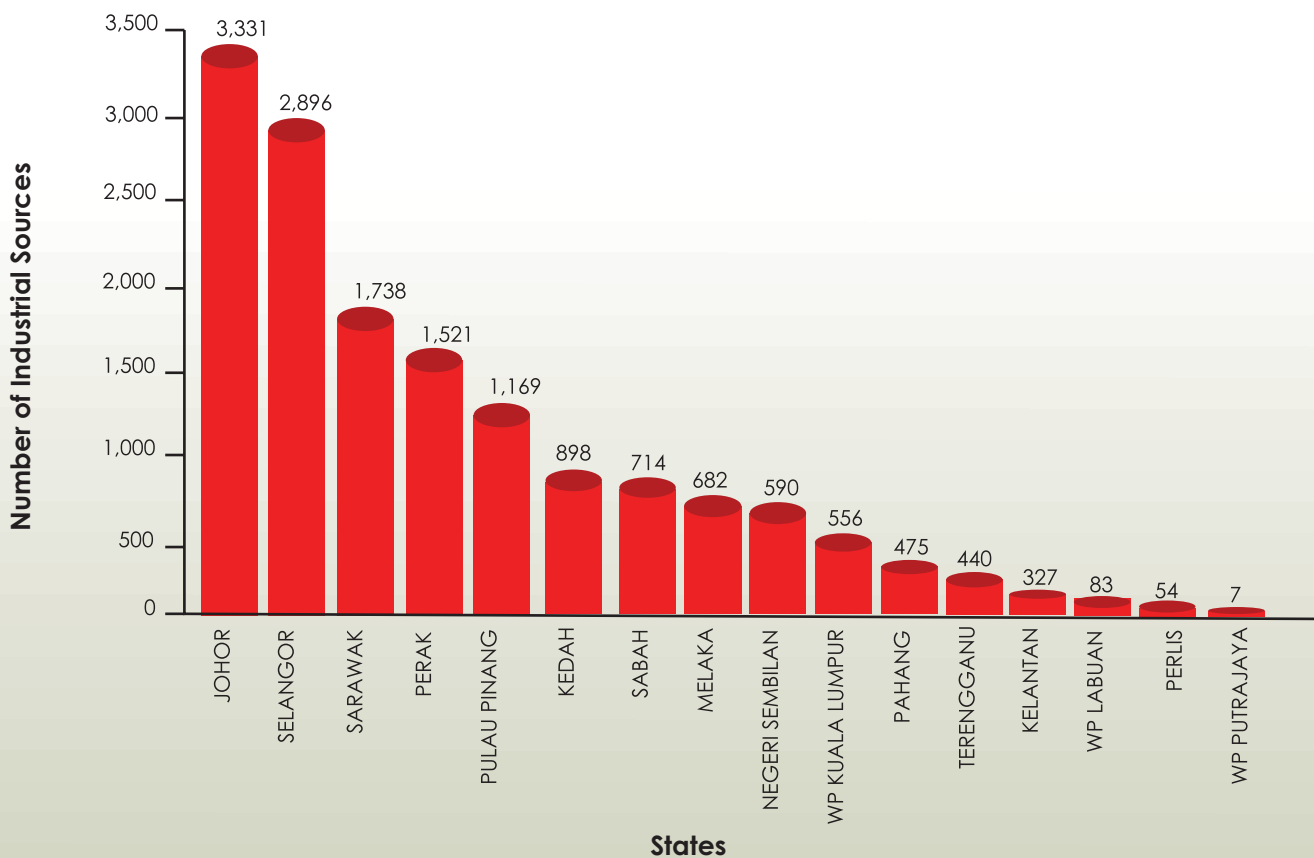


SOURCES OF AIR POLLUTION

Increasing number of in-use motor vehicles over the past decade and fast development of industrial sector among the major contributions of air pollution in the country.

As of December 2012, a total of 15,481 industrial sources were recorded to be subjected to the Environmental Quality (Clean Air) Regulations, 1978. This shows a slight decrease in terms of the number of sources of air pollution this year compared to 15,583 sources in 2011. The distribution of industrial sources by states is as shown in **Figure 5.7**. The highest number of stationary pollution sources was in Johor (3,331: 21.52%) followed by Selangor (2,896: 18.71%) and Sarawak (1,738: 11.23%).

As for the past years motor vehicles remained as the major source of air pollution especially in urban areas. In 2012, there was an overall increase in the number of motor vehicles registered. The number of registered passenger cars increased by 6.51%, motorcycles 6.05%, goods vehicles 3.44%, taxis 3.35% and buses by 2.44% compared to 2011. The number of registered vehicles in Malaysia as reported by the Department of Road Transport for the year 2011 and 2012 is as shown in **Figure 5.8**. On the other hand, as for the number of in-use or active vehicles on the road had shown an increasing trend. In 2012, the number of motorcycles increased by 10.30%, passenger cars 6.88%, goods vehicles 3.71%, buses 1.19% and taxis 0.75% compared to 2011 (**Figure 5.9**)



(Sources: Environmental Pollution Inventory Information System (SIMPAS), Department Of Environment, 2012)

Figure 5.7 Malaysia: Industrial Air Pollution Sources by State, 2012

AIR POLLUTANT EMISSION LOAD

OVERALL EMISSION LOAD

It was estimated that in 2012 the combined air pollutant emission load accumulated to 1,873,730 metric tonnes of carbon monoxide (CO); 877,364 metric tonnes of nitrogen oxides (NO₂); 198,519 metric tonnes of sulphur dioxide (SO₂) and 6,049 metric tonnes of particulate matter (PM). A comparison of the combined air pollutant emission load in 2011 and 2012 is shown in **Figure 5.10**.

Emission load for PM in 2012 had decreased by 77.4% compared to 2011 due to major shift in type of fuel usage from diesel to natural gas and LPG in industries and other sectors such as agricultural, commercial and residential.

The increase of 6.5% in CO emission load was due to an increase in the number of in-use or active motor vehicles in 2012 while the increase of emission load for NO₂ and SO₂ could be due to high consumptions of coke which was used as fuel in the power and heat generation plant (Sources: National Energy Balance, 2010).

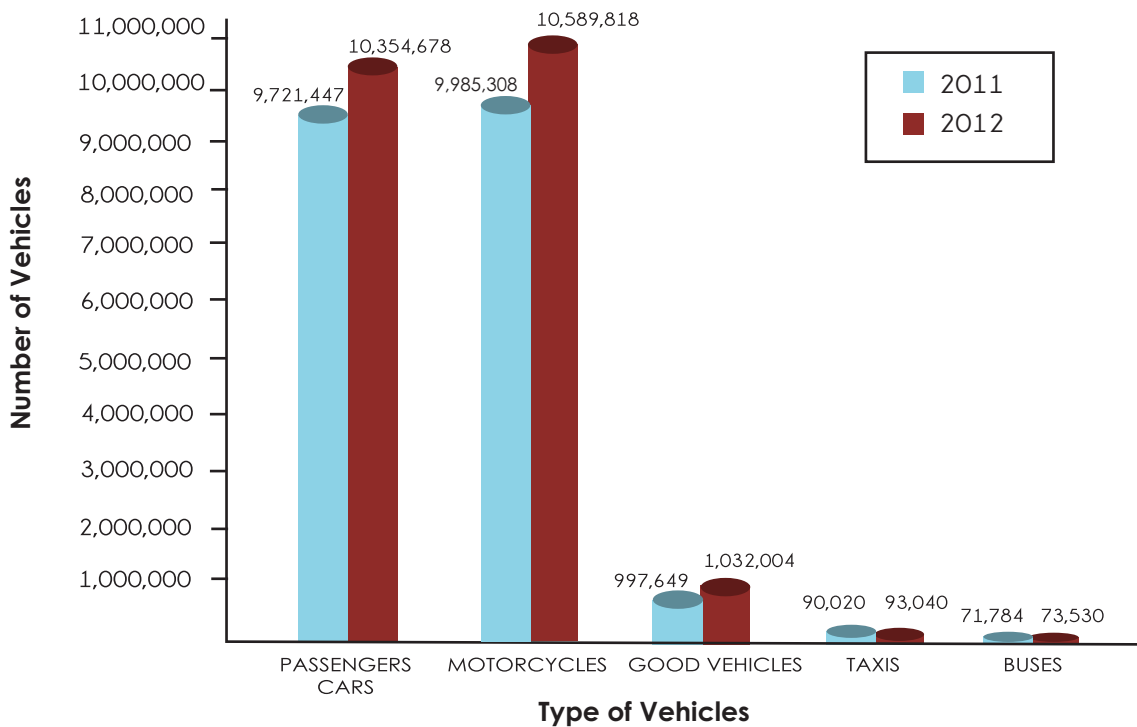
EMISSION LOAD BY SOURCES

Power plants contributed the highest SO₂ emission load (48%), followed by others (35%), industries (10%) and motor vehicles (7%) (**Figure 5.11**). As for PM the highest contributor was motor vehicles (76 %) followed by power plants (15%), others (5%) and industries (4%) (**Figure 5.12**). As shown in **Figure 5.13** the highest contributor of NO₂ was power plants (60%) followed by motor vehicles (26%), others (8%) and industries (6%). However, motor vehicles remain the highest contributor of CO (94.97 %) (**Figure 5.14**).

The estimated annual air pollutant emission load of HC, CO, PM, NO₂ and SO₂ from motor vehicles for 2011 and 2012 is shown in **Figure 5.15**. In 2012, the emission load of HC and CO was estimated to be 426,430 metric tonnes and 1,779,409 metric tonnes respectively. There was an increased of 8.70% of HC emission load and 6.49% of CO emission load in 2012 as compared to 2011. A similar trend was also observed for the emission load of SO₂, NO₂ and PM. Emission load of PM was 4,585 metric tonnes in 2012 as compared to 4,437 metric tonnes in 2011 (3.33% increased); SO₂ was 14,391 metric tonnes in 2012 as compared to 13,743 metric tonnes in 2011 (4.72% increased); and NO₂ was 226,209 metric tonnes as compared to 216,428 tonnes in 2011 (4.52% increased).

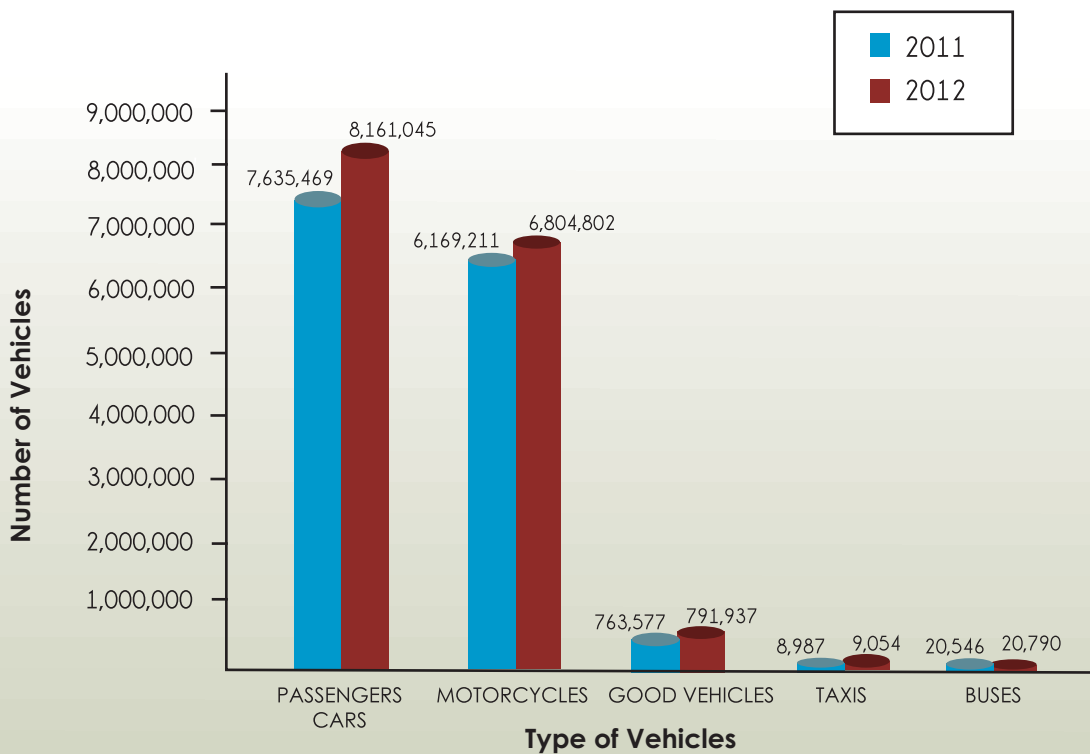
Therefore, there was an overall increase in emission load for HC, CO, NO₂, SO₂ and PM contributed by motor vehicles.





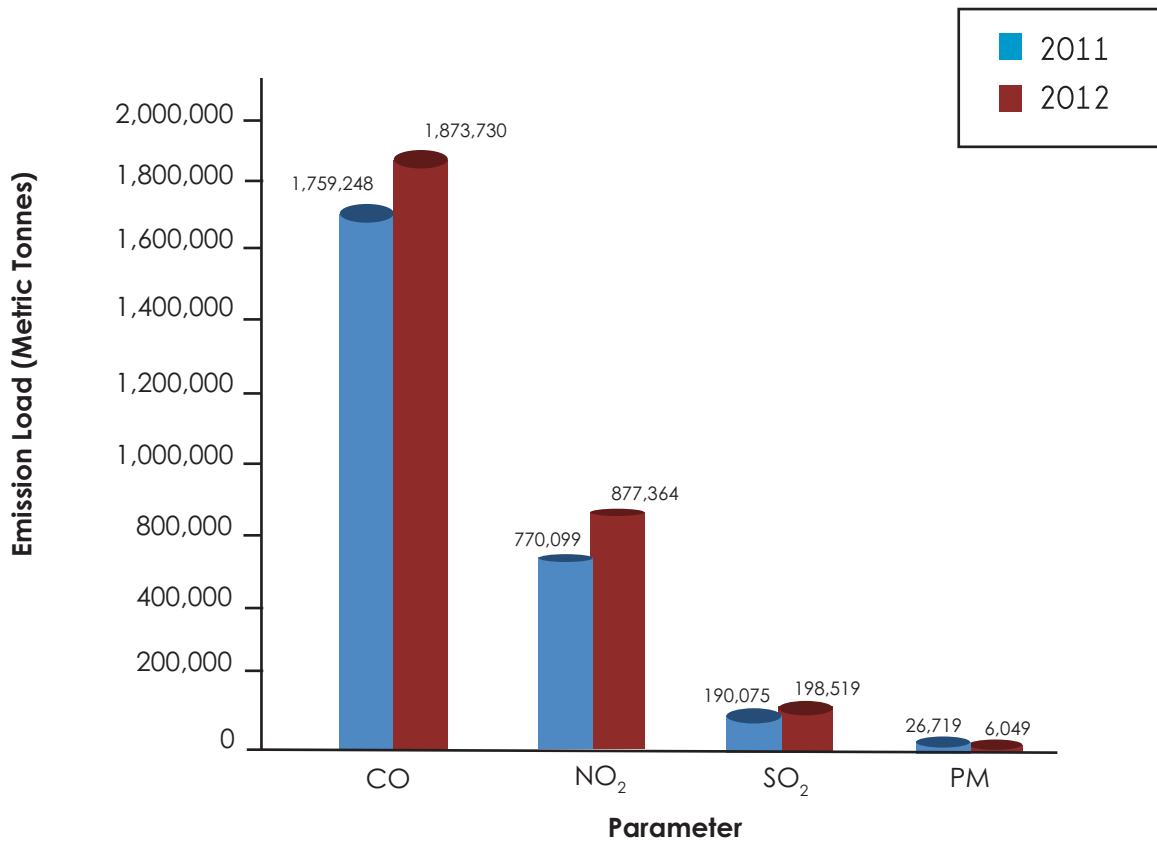
(Source: Road Transport Department, Malaysia, 2012)

Figure 5.8 Malaysia: Number of Registered Vehicles, 2011–2012



(Source: Road Transport Department, Malaysia, 2012)

Figure 5.9 Malaysia: Number of in Use Vehicles, 2011–2012



(Sources: From National Energy Balance 2010)

Figure 5.10 Malaysia: Air Pollutant Emission Load from All Sources, 2011-2012

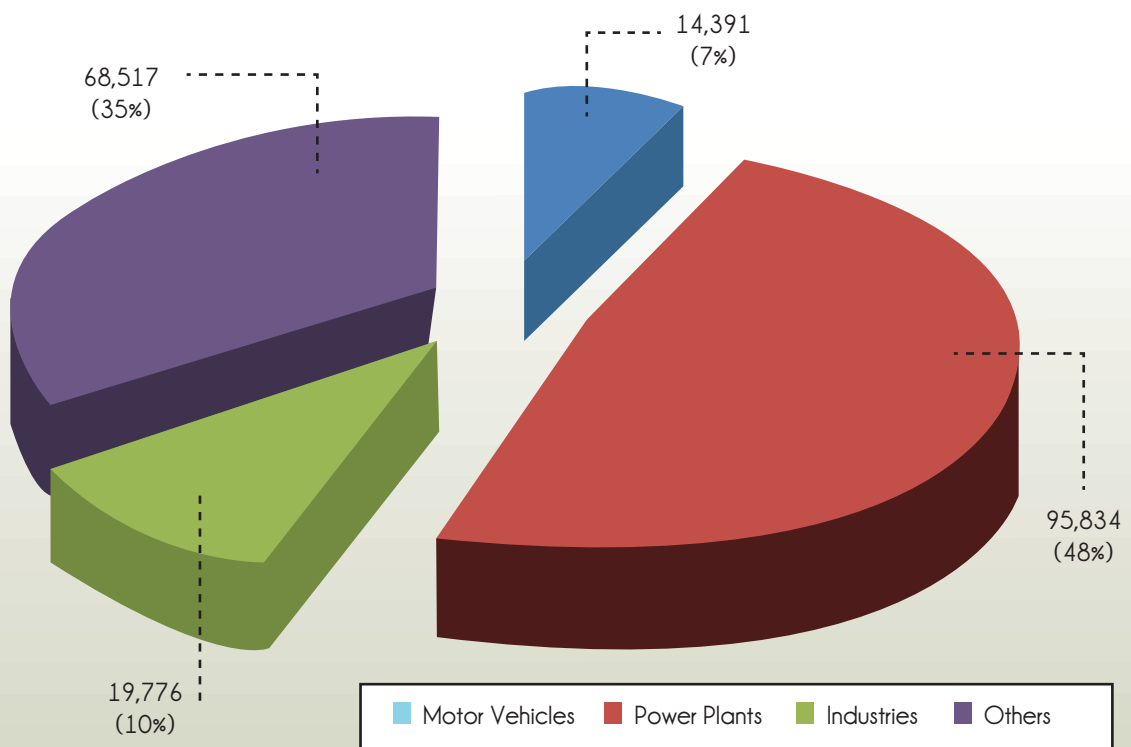


Figure 5.11 Malaysia: SO₂ Emission by Sources (Metric Tonnes), 2012

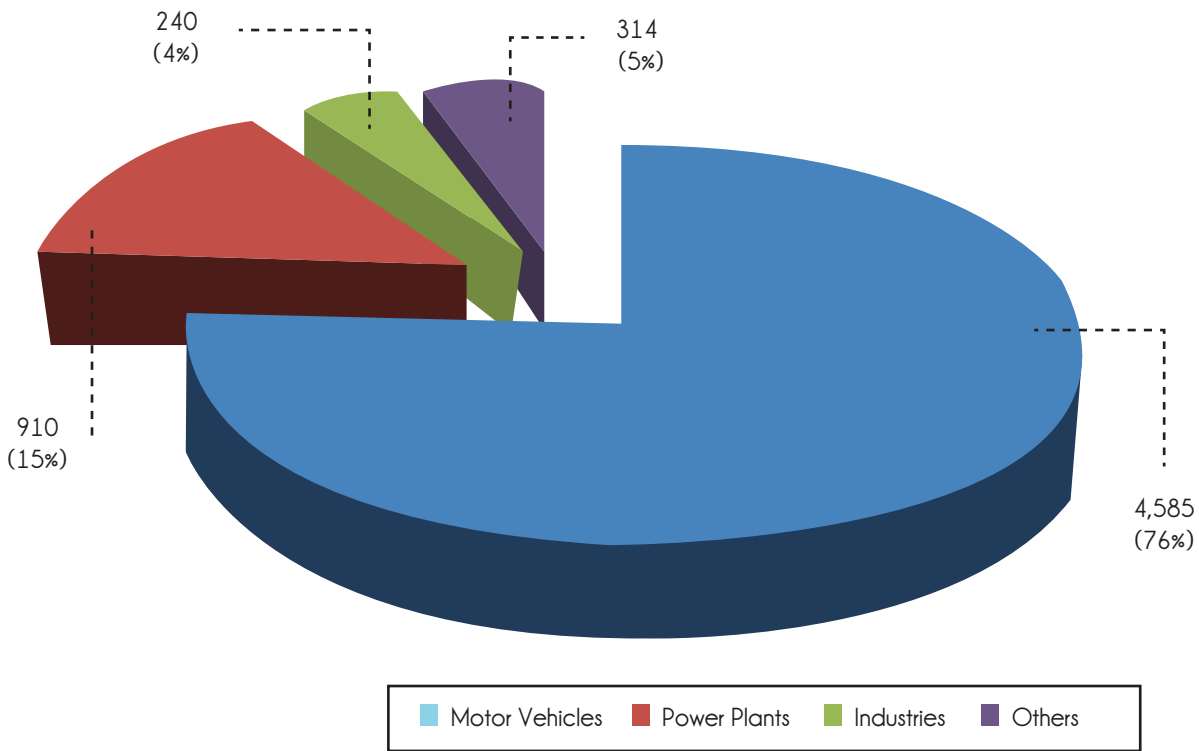


Figure 5.12 Malaysia: Particulate Matter (PM) Emission Load by Sources (Metric Tonnes), 2012

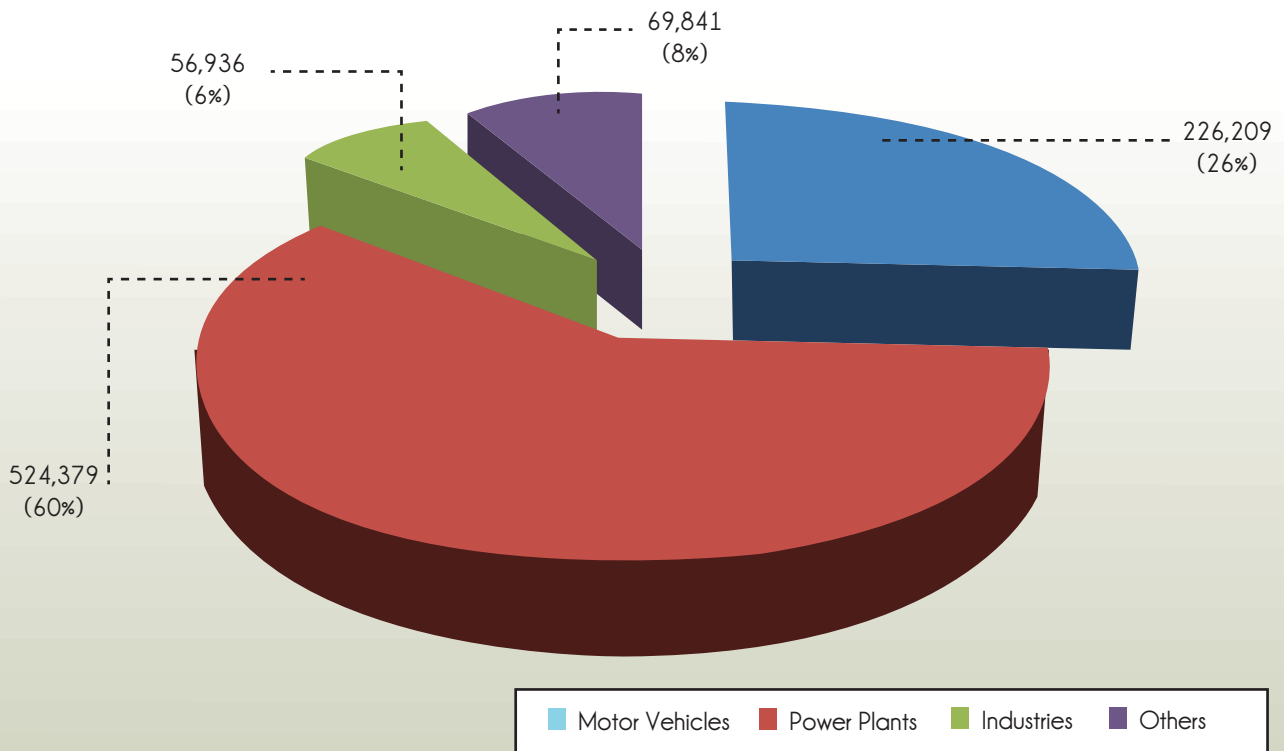


Figure 5.13 Malaysia: NO₂ Emission by Sources (Metric Tonnes), 2012

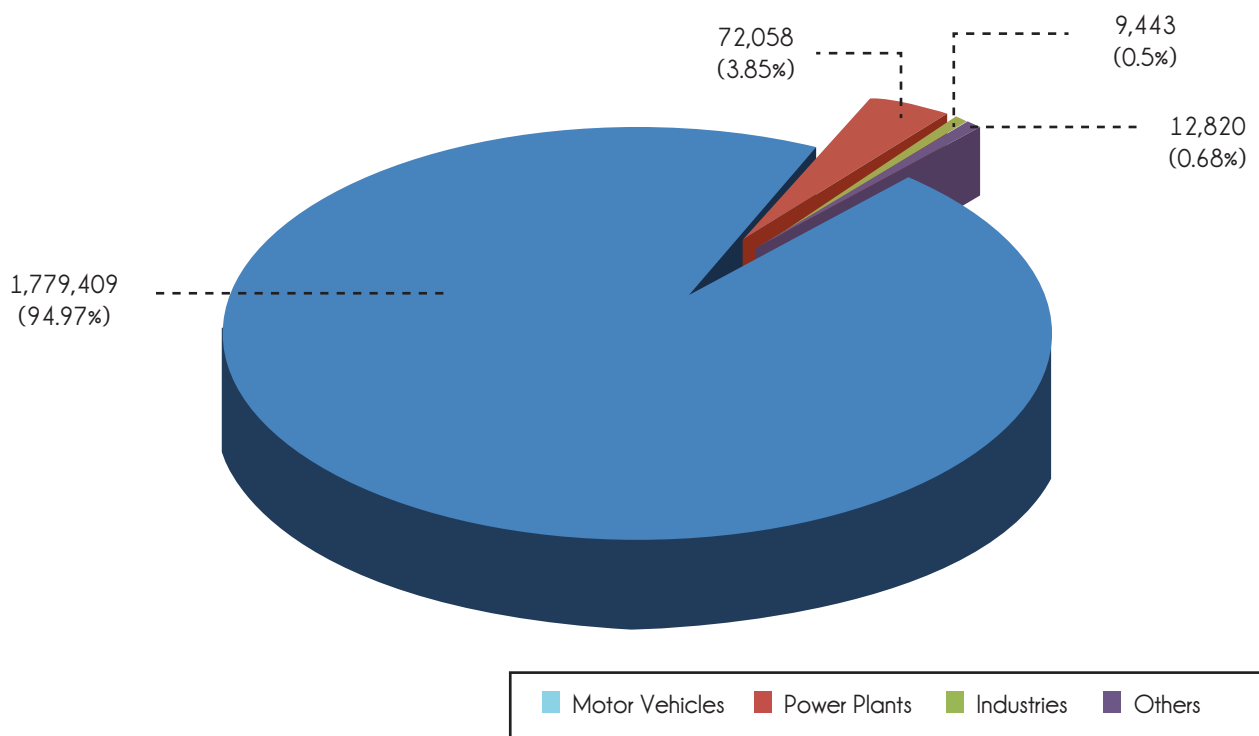


Figure 5.14 Malaysia: CO Emission by Sources (Metric Tonnes), 2012

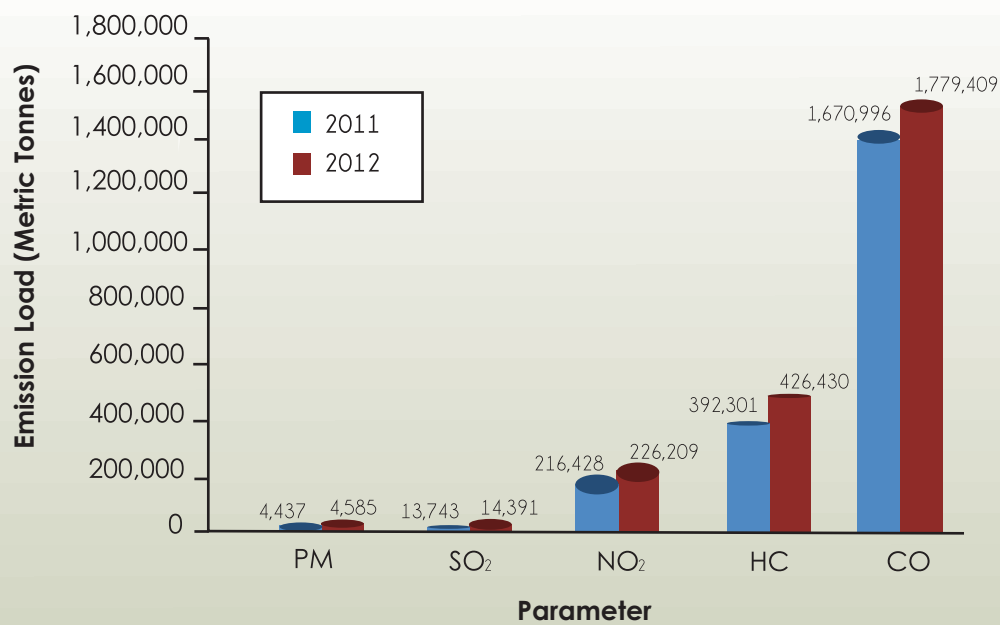


Figure 5.15 Malaysia: Air Pollutant Emission Load from Motor Vehicles, 2011-2012

SCHEDULED WASTES INVENTORY

In 2012, a total of 2,854,516.78 metric tonnes of scheduled wastes were generated. This represents an overall decrease of 13.01% as compared to 3,281,569.73 metric tonnes reported in 2011. Of the total waste generated, dross/slag/clinker/ash, gypsum, mineral sludge, oil & hydrocarbon, heavy metal sludge and e-waste were the main categories (**Table 5.2**). Referring to **Figure 5.19**, the state of Terengganu generated the largest amount of scheduled wastes (20.9%), followed by Johor (20.14%), Perak (14.23%), Selangor (12.87%), Pulau Pinang (8.58%), whilst the other 10 states generated a total of 23.28%.

A total of 600,672.99 metric tonnes (35.15%) of waste were being recovered locally and internationally. This shows a decreased of 36.08% as compared to 939,730.83 metric tonnes in 2011. From the total, 596,527.89 metric tonnes (34.91%) of scheduled wastes were recovered at local off-site facilities and 4,145.10 metric tonnes (0.24%) were exported for recovery purposes in foreign facilities.

A total of 139,084.41 metric tonnes (8.14%) of waste were treated and disposed for final disposal, at Kualiti Alam Sdn. Bhd. (105,151.05 MT), Trienekens (Sarawak) Sdn. Bhd. (15,878.33 MT) and 18,055.03 metric tonnes of clinical wastes were incinerated at licensed off-site facilities (**Table 5.3**). This shows a decrease of 8.48% from a total of 151,979.5 metric tonnes of scheduled waste disposed in 2011.

A total of 674,332.66 metric tonnes (39.46%) of scheduled waste were treated on-site; while 294,618.67 metric tonnes (17.24%) were stored on-site at waste generators' premises (**Table 5.3**). Two (2) land farms and 16 on-site waste incinerators had been licensed by DOE to allow for on-site treatment and incineration respectively.



Of the total waste produced in 2012, 1,145,808.05 metric tonnes (40.14%) were granted conditional approval to be managed under special management as stipulated under Regulation 7, Environmental Quality (Scheduled Wastes) Regulations, 2005 (**Table 5.4**). This represents a decreased of 30.9% as compared to 1,659,537.67 metric tonnes in 2011. These waste streams were mostly generated from coal-fired power plant (64.87%), sludges from drinking water treatment facilities (16.64%) and others (18.49%).

In 2012, a total of 446 off-site recovery facilities have been licensed by the department to recover various categories of scheduled wastes. The most issued licensed facilities according to categories of waste are electronic and electrical wastes (153 facilities) followed by oil/ mineral sludge/spent coolant (58 facilities) dross/ ash/ slag/ catalyst (57 facilities), heavy metal sludge/ rubber (37 facilities), used container/ contaminated waste/ ink/ paint/ lacquer (34 facilities), solvent (31 facilities) and acid/ alkaline (27 facilities), whilst four (4) other wastes categories totaling of 49 facilities are as shown in **Table 5.5**.

The categories of wastes sent to the licensed premises (Kualiti Alam Sdn Bhd and Trinekens (Sarawak) Sdn Bhd) for final disposal are sludges containing one or several metals, mixed wastes, dust/slag/dross/ or ash containing arsenic/mercury and spent inorganic acid. These wastes were either incinerated, treated physically and chemically, solidified or disposed off in secured landfill depending on their characteristics. As shown in **Figure 5.21**, most of the wastes sent to Kualiti Alam Sdn Bhd and Trienekens Sdn Bhd are being landfilled (51%) followed by incineration (37%), physically and chemically treated (6%) and treated solidified (6%)



Table 5.2 Malaysia: Quantity of Scheduled Wastes Generated by Category, 2012

No	Waste Category	Waste Code	Quantity of Waste	
			MT/Year	Percentage (%)
1	Dross / Slag / Clinker / Ash	SW 104	364,425.95	21.33
2	Gypsum	SW 205	337,771.68	19.77
3	Mineral Sludges	SW 427	316,938.39	18.55
4	Oil & Hydrocarbon	SW 305	154,113.37	9.02
5	Heavy Metal Sludges	SW 204	120,793.29	7.07
6	E-Waste	SW 110	78,278.05	4.58
7	Used Containers	SW 409	67,406.83	3.94
8	Batteries	SW 102	42,919.49	2.51
9	Spent Acids	SW 206	33,411.90	1.96
10	Mixed Wastes	SW 422	30,154.40	1.76
11	Rubber Sludges	SW 321	22,401.82	1.31
12	Residue	SW 501	22,055.21	1.29
13	Pathogenic Waste Clinical	SW 404	20,865.09	1.22
14	Contaminated Paper & Plastic	SW 410	18,921.38	1.11
15	Waste of Inks & Paints	SW 417	14,665.72	0.86
16	Waste of Halogenated Solvents	SW 323	13,364.96	0.78
17	Waste of Non-Halogenated Solvents	SW 322	9,814.18	0.57
18	Spent Alkalis	SW 401	8,848.92	0.52
19	Inks & Paints Sludges	SW 416	7,243.24	0.42
20	Catalyst	SW 202	5,320.51	0.31
21	Phenol/ Adhesive / Resin	SW 325	4,550.08	0.27
22	Expired Drug	SW 403	3,684.22	0.22
23	Pesticide	SW 425	3,146.30	0.18
24	Contaminated Land / Soil	SW 408	1,427.32	0.08
25	Contaminated Active Carbon	SW 411	1,405.59	0.08
26	Formaldehyde Waste	SW 320	1,214.28	0.07
27	Photographic Waste	SW 423	728.61	0.04
28	Mercury	SW 109	698.27	0.04
29	Chemical Waste	SW 430	455.08	0.03
30	Sludge Containing Fluoride	SW 207	346.50	0.02
31	Sludge Containing Cyanide	SW 412	279.80	0.02
32	Stabilized Sludges	SW 203	262.30	0.02
33	Arsenic	SW 101	228.09	0.01
34	Asbestos	SW 201	184.91	0.01
35	Thermal Fluids	SW 327	173.29	0.01
36	Flux waste	SW 302	107.27	0.01
37	Lab Waste	SW 429	100.77	0.01
38	Waste Containing PCB or PCT	SW 318	1.30	0.00
39	Spent di-Isocyanates	SW 419	0.39	0.00
	Total		1,708,708.73	100.00

Table 5.3 Malaysia: Facilities Handling Scheduled Wastes, 2012

No.	Facility	Metric Tonnes	Percentage (%)
1	On-site Treatment	674,332.66	39.46
2	Local Off-site Recovery Facilities	596,527.89	34.91
3	On-site Storage	294,618.67	17.24
4	Kualiti Alam Sdn. Bhd	105,151.05	6.15
5	Off-site Clinical Waste Incinerators	18,055.03	1.06
6	Trienekens (Sarawak) Sdn. Bhd.	15,878.33	0.93
7	Foreign Facilities (Export)	4,145.10	0.24
	Total	1,708,708.73	100.00

Table 5.4 Malaysia: Generated Scheduled Wastes Managed Under Special Management, 2012

No.	Waste Category	Waste Code	Source	Metric Tonnes	Percent (%)	Method of Disposal)
1	Heavy Metal Sludge	SW 204	Drinking Water Treatment Plant	190,622.00	16.64	Sanitary Landfill
			Industry	109,072.64	9.52	
2	Fly Ash & Bottom Ash	SW 104	Coal-Fired Power Plant	743,329.06	64.87	Reuse as raw material for product
			Industry	22,457.72	1.96	
3	Gypsum	SW 205	Industry	68,734.50	6.00	Sanitary landfill
4	Glue	SW 303	Industry	1.80	0.00	Reuse as raw material for product
5	Petroleum By Product	SW 322	Industry	439.77	0.04	Recovered
6	Waste Containing Formaldehyde, resin, discarded epoxy powder	SW 320, 325, 418	Industry	7,182.20	0.63	Sanitary Landfill
7	Discarded Pharmaceutical Product, Discarded Product	SW 405, 429	Industry	31.42	0.00	Sanitary Landfill
8	Ash of Paper Sludge	SW 406	Industry	3,936.94	0.34	Sanitary Landfill
9	Spent Mixed Oil	SW 421	Industry	0.01	0.00	Reuse as releasing agent for mould cement
TOTAL				1,145,808.05	100	

Table 5.5 Malaysia: Off-site Recovery Facilities and Quantity of Waste Handling, 2012

Waste Category	Recovery Facility
Electronic and Electrical Wastes	153
Oil / Mineral Sludge / Spent Coolant	58
Dross / Ash / Slag / Catalyst	57
Heavy Metal Sludge / Rubber	37
Used Container / Contaminated Waste / Ink / Paint / Lacquer	34
Solvent	31
Acid / Alkaline	27
Phenol / Adhesive / Resin	23
Photographic	12
Battery	7
Gypsum	7
Total	446

Figure 5.16 Malaysia: Quantity of Scheduled Wastes Generated by Category,

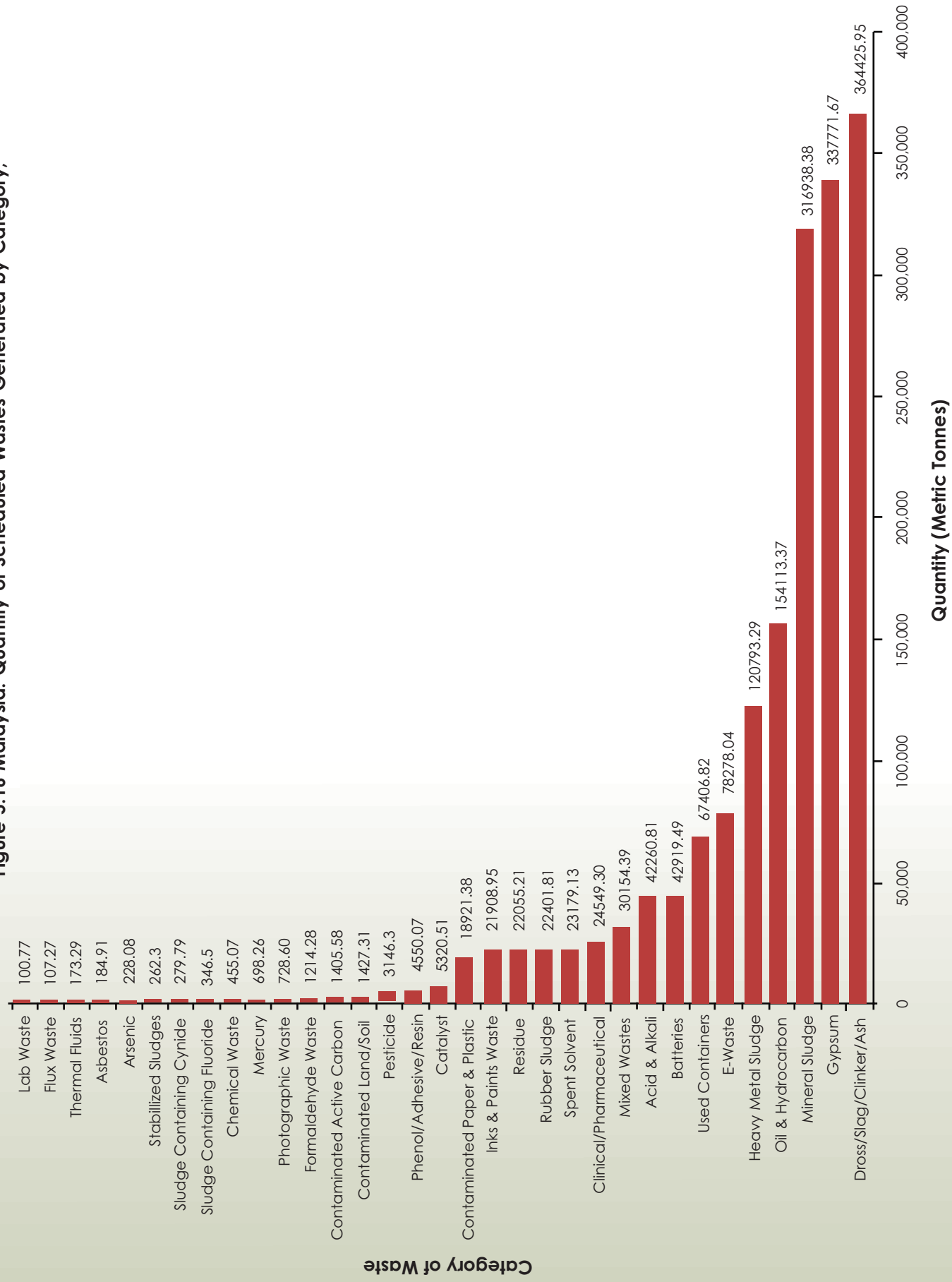
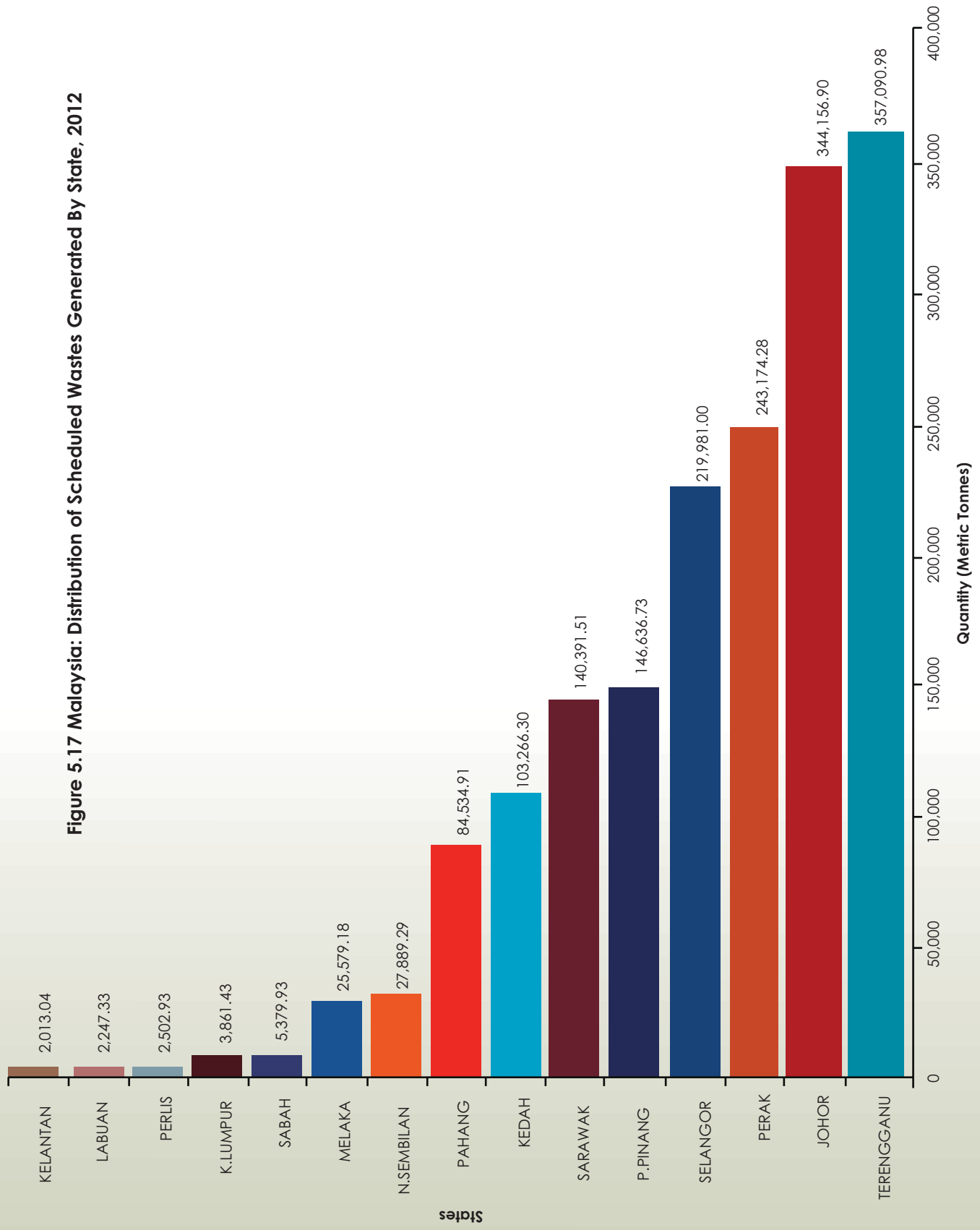


Figure 5.17 Malaysia: Distribution of Scheduled Wastes Generated By State, 2012



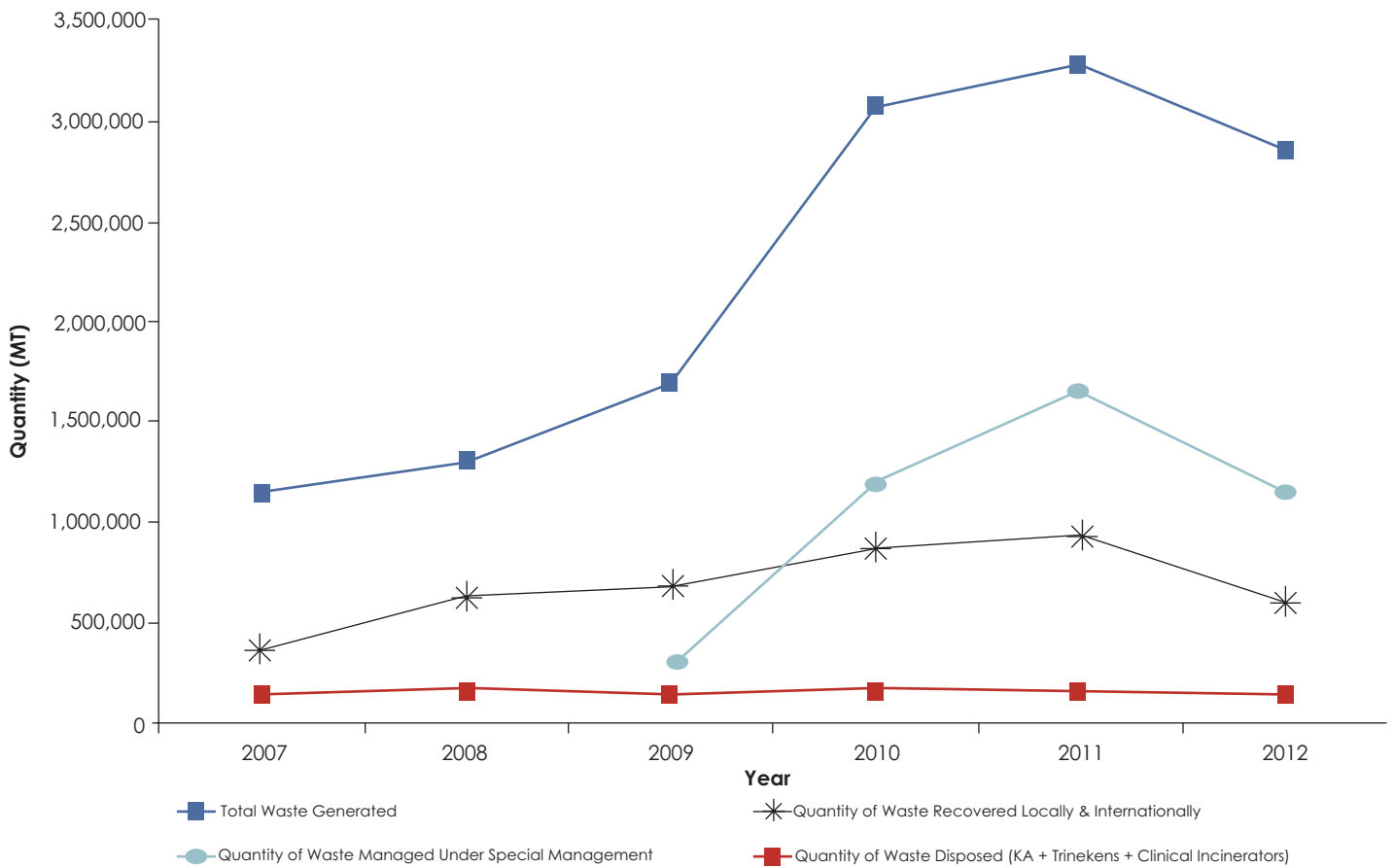


Figure 5.18 Malaysia: The Trend of Scheduled Waste Management from 2007 - 2012

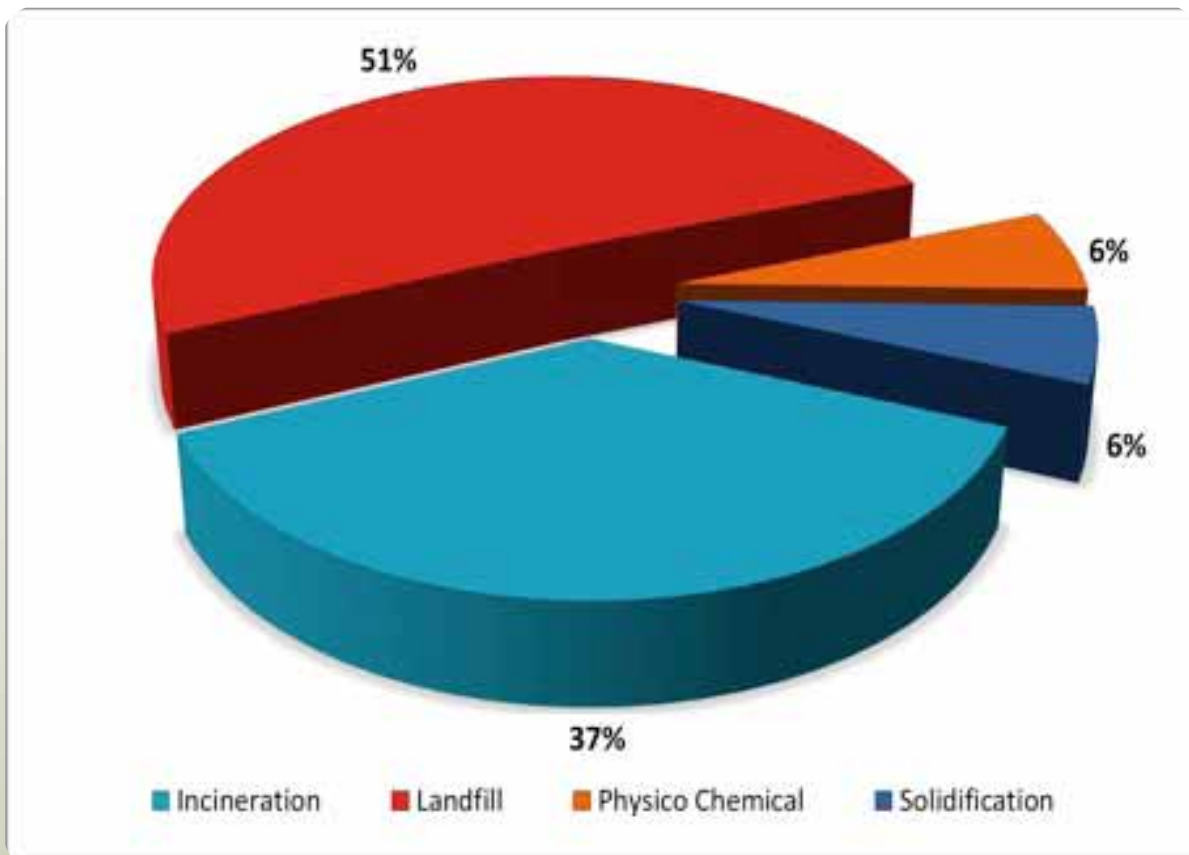


Figure 5.19 Malaysia: Types of Treatment and Disposal of Waste, 2012

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	
Mn	mg/l		0.1	0.1	0.2	
Hg	mg/l	N	0.001	0.004 (0.0001)	0.002	E
Ni	mg/l	A	0.05	0.9*	0.2	V
Se	mg/l	T	0.01	0.25 (0.04)	0.02	E
Ag	mg/l	U	0.05	0.0002	-	L
Sn	mg/l	R	-	0.004	-	S
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)	-	V
F	mg/l	E	1.5	10	1	E
NO ₂	mg/l	L	0.4	0.4 (0.03)	-	I
NO ₃	mg/l	S	7	-	5	V
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		-	-	-	
Gross-α	Bq/l	A	0.1	-	-	
Gross-β	Bq/l	B	1	-	-	
Ra-226	Bq/l	S	< 0.1	-	-	
Sr-90	Bq/l	E	< 1	-	-	
CCE	µg/l	N	500	-	-	
MBAS/BAS	µg/l	T	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 CaCO₃

= 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	V	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 * SlpH)
where;

SIDO = Subindex DO (% saturation)

SIBOD = Subindex BOD

SICOD = Subindex COD

SIAN = Subindex NH₃-N

SISS = Subindex SS

SlpH = Subindex pH

0 ≤ WQI ≤ 100

BEST FIT EQUATIONS FOR THE ESTIMATION OF VARIOUS SUBINDEX VALUES

Subindex for DO (in % saturation)

SIDO = 0 for x ≤ 8
SIDO = 100 for x ≥ 92
SIDO = -0.395 + 0.030x² - 0.00020x³ for 8 < x < 92

Subindex for BOD

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

Subindex for COD

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

Subindex for NH₃-N

SIAN = 100.5 - 105x for x ≤ 0.3
SIAN = 94 * exp(-0.573x) - 5 * |x - 2| for 0.3 < x < 4
SIAN = 0 for x ≥ 4

Subindex for SS

SISS = 97.5 * exp(-0.00676x) + 0.05x for x ≤ 100
SISS = 71 * exp(-0.0061x) - 0.015x for 100 < x < 1000
SISS = 0 for x ≥ 1000

Subindex for pH

SlpH = 17.2 - 17.2x + 5.02x² for x < 5.5
SlpH = -242 + 95.5x - 6.67x² for 5.5 ≤ x < 7
SlpH = -181 + 82.4x - 6.05x² for 7 ≤ x < 8.75
SlpH = 536 - 77.0x + 2.76x² for x ≥ 8.75

Note:

* means multiply with

MWQI FORMULA AND CALCULATION

$$\text{MWQI} = \text{SI DO} \cdot 0.2 \times \text{SI NH}_3 \cdot 0.16 \times \text{SI FC} \cdot 0.14 \times \text{SI TSS} \cdot 0.14 \times \text{SI O\&G} \cdot 0.13 \times \text{SI NO}_3 \cdot 0.12 \times \text{SI PO}_4 \cdot 0.11$$

where;

SIDO	= Subindex Dissolved Oxygen
SINH ₃	= Subindex Unionized Ammonia
SIFC	= Subindex Faecal Coliform
SITSS	= Subindex Total Suspended Solids
SIO&G	= Subindex Oil and Grease
SINO ₃	= Subindex Nitrate
SIPO ₄	= Subindex Phosphate
0 ≤ MWQI ≤ 100	

BEST FIT EQUATIONS FOR THE ESTIMATION OF VARIOUS SUBINDEX VALUES

<p>Dissolved Oxygen (DO) in mg/L</p> <p>For DO between 3 and 7</p> $SI(DO) = -85.816 + 55.476(DO) - 4.142(DO)^2$ <p>If DO is less than 3, or more than 10, SI = 10%</p>
<p>Ammonia (Unionized) (NH₃) in mg-N/L*</p> $SI(NH_3) = 100 \exp^{-4.6(NH_3)}$ <p>* If Ammoniacal Nitrogen (NH₃⁺-N) is measured, convert the value into unionized ammonia.</p>
<p>Faecal Coliform (FC) in MPN/100ml</p> $SI(FC) = 100 \exp^{-0.005(FC)}$ <p>If FC ≥ 500 MPN, SI = 8%</p>
<p>Total Suspended Solids (TSS) in mg/L</p> $SI(TSS) = 95.8 \exp^{-0.0043(TSS)}$ <p>If TSS > 100 mg/L, SI = 20%</p>
<p>Oil & Grease (OG) in mg/L</p> $SI(OG) = 98 \exp^{-0.21(OG)}$
<p>Nitrate (NO₃) in mg-N/L</p> $SI(NO_3) = 94.83 \exp^{-0.35(NO_3)}$
<p>Phosphate (PO₄) in mg-P/L</p> $SI(PO_4) = 95.2 \exp^{-0.002(PO_4 * 1000)}$

UNIONIZED AMMONIA CALCULATION

In order to convert the concentration of total ammoniacal nitrogen into unionized ammonia, calculate (a), (b), (c) and (d). Substitute the results into equation 1.

a. Calculation of Ionic Strength (IS)

$$IS = \frac{19.9273 * Salinity}{(1000 - 1.005109 * Salinity)}$$

Salinity in part per thousand (ppt)

b. Calculation of PKa

$$PKa = (0.0901821 +) \frac{2729.92}{(Temp + 273.15)} + IS(0.1552 - 0.000314 * Temp)$$

Temperature in °C

c. Calculation of working pH

$$pH_{sw} = pH - (0.0007 * IS) - 0.131$$

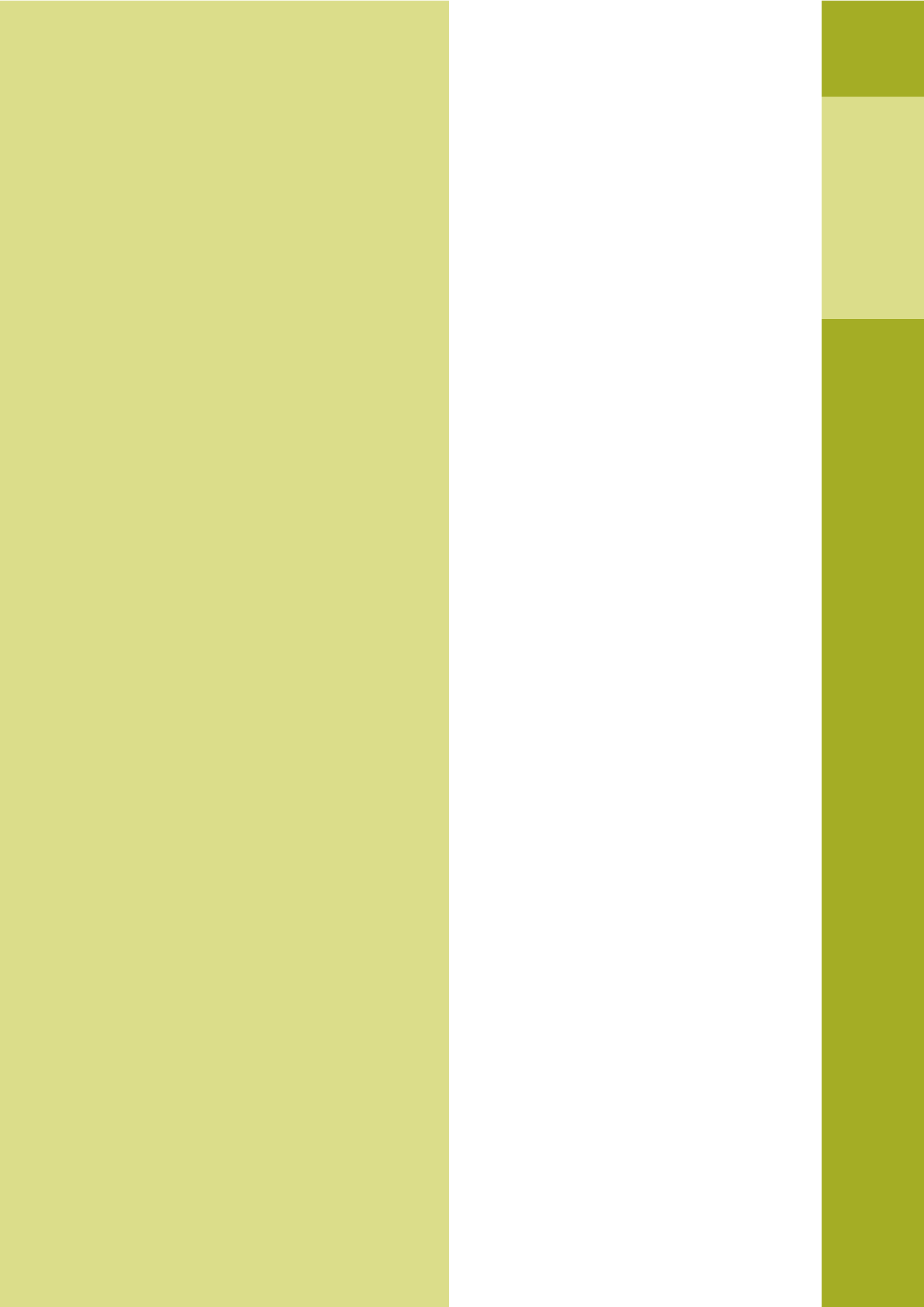
d. Calculation of mole fraction for unionized ammonia

$$\text{Mole Fraction} = \frac{1}{1 + 10^{(PKa - pH_{sw})}}$$

Equation:

$$\text{Unionized ammonia} = \text{Total ammoniacal nitrogen} \times \text{mole fraction}$$

Total ammoniacal nitrogen should be measured in µg/l



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Ministry of Natural Resources and Environment
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