DEPARTMENT OF ENVIRONMENT
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

LAPORAN KUALITI ALAM SEKELILING MALAYSIA

MALAYSIA ENVIRONMENTAL QUALITY REPORT

2013

Dato' Halimah Hassan

Ketua Pengarah Alam Sekitar Malaysia

Director-General of Environmental Quality Malaysia

Saya amat berbesar hati untuk membentangkan Laporan Kualiti Alam Sekeliling 2013 seperti yang dikehendaki di bawah Seksyen 3(1)(i) Akta Kualiti Alam Sekeliling 1974.

It is my pleasure to present the Environmental Quality Report 2013 as required under Section 3(1)(i) of the Environmental Quality Act 1974.

Kualiti persekitaran marin kawasan pantai, muara dan pulau adalah dalam variasi yang memuaskan berdasarkan Indeks Kualiti Air Marine (IKAM). Sementara itu, peratus bilangan sungai yang dikategorikan sebagai tercemar telah berkurang daripada 7% pada tahun 2012 kepada 5% pada tahun 2013. Walau bagaimanapun, peratus bilangan sungai yang dikategorikan sebagai bersih telah menurun sedikit kepada 58% pada tahun 2013 berbanding tahun sebelumnya (59%).

The quality of the marine environment with respect to coastal, estuarine and island areas was within normal variations compared with the Marine Water Quality Index (MWQI). Meanwhile, the percentage of polluted rivers has decreased from 7% in 2012 to 5% in 2013. However, the percentage of clean rivers has slightly decrease to 58% in 2013 compared to the previous year (59%).

Malaysia telah mengalami episod jerebu yang singkat pada 15 hingga 27 Jun 2013 yang disebabkan oleh pencemaran merentas sempadan.

Malaysia had experienced a short period of severe haze episode from 15 to 27 June 2013 due to trans-boundary pollution.

Semasa episod jerebu, bacaan IPU tertinggi yang dicatatkan adalah di Daerah Muar, Johor iaitu melebihi paras 500. Berikutan itu, pada 23 Jun 2013, YAB Perdana Menteri Malaysia telah mengambil tindakan segera untuk mengawal dengan mengisytiharkan keadaan Darurat Bencana Jerebu bagi

During the haze episode, the highest API reading was recorded in Muar District, Johor where it exceeded more than 500. Consequently, a haze emergency was declared by the Hon. Prime Minister on 23 June 2013 in Muar and Ledang Districts, Johor and was subsequently lifted on 24

seluruh Daerah Muar dan Daerah Ledang. Pengisytiharan keadaan Darurat Bencana Jerebu ini telah ditarik balik pada 24 Jun 2013 apabila penurunan bacaan IPU bawah paras 300 dan jarak penglihatan bertambah baik. Selain daripada episod jerebu ini, tiada kejadian pencemaran udara lain yang teruk berlaku pada tahun 2013.

June 2013 after the API level in both areas dropped to below 300, further improving visibility. Apart from this haze episode, there were no other serious air pollution incidences in 2013.

JAS telah mengorak langkah dalam usaha usaha untuk memelihara dan memulihara alam sekitar dengan melaksanakan aktiviti – aktiviti kesedaran melalui Program Rakan Alam Sekitar. Marilah kita bersama – sama berganding bahu dalam menjayakan matlamat ini.

DOE has come a long way in driving the efforts to conserving and protecting the environment by implementing environmental awareness activities through the Rakan Alam Sekitar Programme. Lets work hand in hand with the government towards achieving this goal.

Pemuliharaan Alam Sekitar, Tanggungjawab Bersama

Environmental Conservation, Our Shared Responsibility

Dato' Halimah Hassan

Ketua Pengarah Alam Sekitar Malaysia

Director-General of Environmental Quality Malaysia

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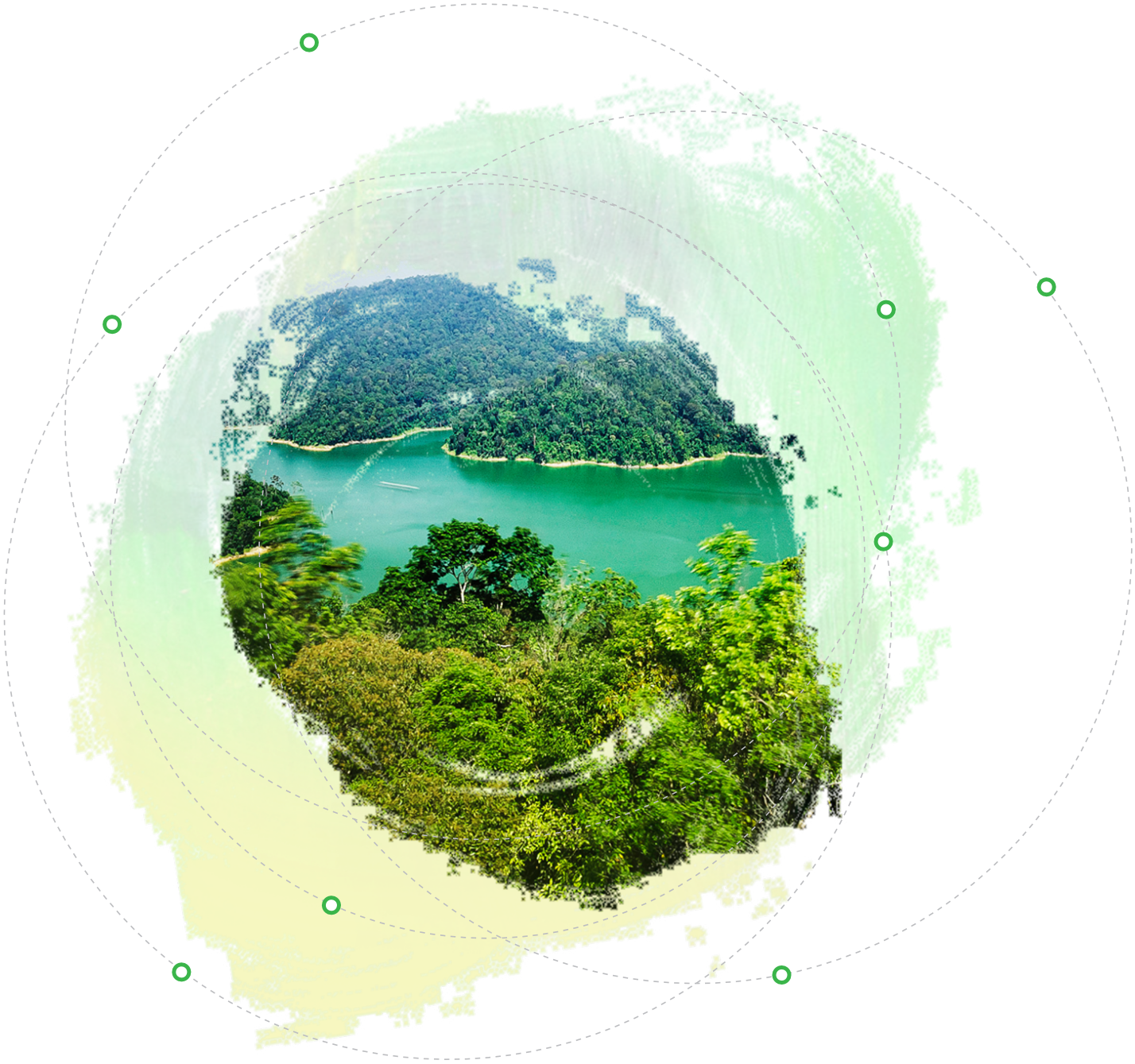


BAB 1
CHAPTER

KUALITI UDARA / AIR QUALITY

PENGAWASAN KUALITI UDARA

Pengawasan status kualiti udara dilaksanakan oleh Jabatan Alam Sekitar (JAS) melalui 52 stesen pengawasan kualiti udara yang ditempatkan di seluruh Negara. Stesen-stesen pengawasan kualiti udara tersebut ditempatkan di lokasi yang strategik iaitu di kawasan bandar, sub- bandar dan perindustrian **(Peta 1.1 dan Peta 1.2)** bertujuan untuk mengesan sebarang perubahan ketara ke atas kualiti udara yang mungkin memberi kesan berbahaya kepada kesihatan dan alam sekitar.

Rangkaian Stesen Pengawasan Kualiti Udara Kebangsaan turut dilengkapi stesen pengawasan kualiti udara secara manual yang ditempatkan di 14 kawasan yang berbeza. Pengawasan udara di stesen manual ini melibatkan pengukuran parameter-parameter seperti kumin pepejal, habuk halus bersaiz kurang dari 10 mikron (PM_{10}) dan beberapa parameter logam berat termasuk plumbum. Bagi stesen manual

AIR QUALITY MONITORING

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

The National Air Quality Monitoring Network is also complemented by manual air quality monitoring stations located at 14 different sites. At these sites, total suspended particulates, particulate matter (PM_{10}) and heavy metals such as lead are measured at interval of six (6) days using High Volume Samplers.

ini, pengukuran dibuat sekali bagi tempoh enam (6) hari dengan menggunakan alat "High Volume Sampler".

Status kualiti udara dilaporkan dalam bentuk Indeks Pencemar Udara (IPU). IPU dikira berdasarkan kepekatan lima (5) bahan pencemar utama iaitu ozon di permukaan bumi (O_3), karbon monoksida (CO), nitrogen dioksida (NO_2), sulfur dioksida (SO_2) dan kumin pepejal yang kurang dari 10 mikron (PM_{10}). IPU ini dikategorikan sebagai baik, sederhana, tidak sihat, sangat tidak sihat dan berbahaya seperti yang dinyatakan dalam **Jadual 1.1.**

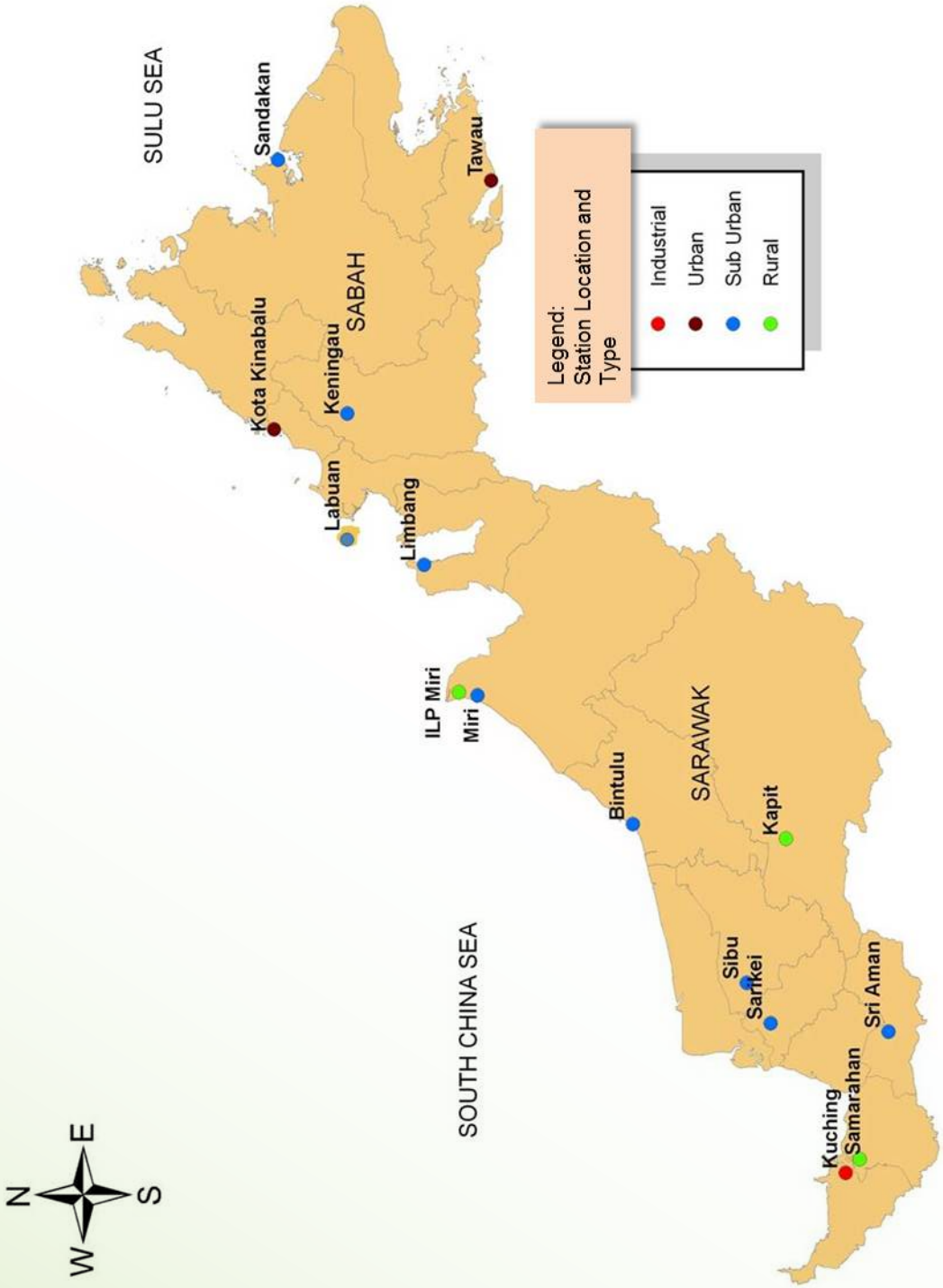
The air quality status is reported in terms of Air Pollution Index (API). The API is calculated based on concentration of five (5) major pollutants which are ground level ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and particulate matter of less than 10 microns in size (PM_{10}). The API is categorized as good, moderate, unhealthy, very unhealthy and hazardous as presented in **Table 1.1.**

API / IPU	STATUS KUALITI UDARA / AIR QUALITY STATUS
0 – 50	Baik / Good
51 – 100	Sederhana / Moderate
101 – 200	Tidak Sihat / Unhealthy
201 – 300	Sangat Tidak Sihat / Very Unhealthy
> 300	Berbahaya / Hazardous

Jadual 1.1 Malaysia : Indeks Kualiti Udara (IPU)
Table 1.1 Malaysia : Air Pollutant Index (API)

Peta 1.1 Malaysia:Lokasi Stesen Pengawasan Kualti Udara Automatik, 2013 di Semenanjung Malaysia

Map 1.1 Malaysia: Location of Continuous Air Quality Monitoring Stations in Peninsular Malaysia, 2013



Peta 1.2 Malaysia: Lokasi Stesen Pengawasan Kualti Udara Automatik Di Sabah & Sarawak, 2013

Map 1.2 Malaysia: Location Of Continuous Air Quality Monitoring Stations In Sabah And Sarawak,2013

STATUS KUALITI UDARA

Malaysia telah mengalami episod jerebu yang singkat pada 15 hingga 27 Jun 2013 yang disebabkan oleh pencemaran merentas sempadan. Kebanyakan kawasan di Semenanjung Malaysia terjejas dan kualiti udara merosot ke tahap yang tidak sihat dan berbahaya. Kawasan yang paling teruk terjejas adalah tiga (3) negeri di Semenanjung Malaysia iaitu Johor, Melaka dan Negeri Sembilan. Semasa episod jerebu, bacaan IPU tertinggi yang dicatatkan adalah di Daerah Muar, Johor iaitu melebihi paras 500. Berikutan itu, pada 23 Jun 2013, YAB Perdana Menteri Malaysia telah mengisytiharkan keadaan Darurat Bencana Jerebu bagi seluruh Daerah Muar dan Daerah Ledang pada 23 Jun 2014. YAB Perdana Menteri pada 24 Jun 2013 telah menarik balik pengisytiharan keadaan Darurat Bencana Jerebu berikutan penurunan bacaan IPU di bawah paras 300 dan jarak penglihatan bertambah baik. Selain daripada episod jerebu ini, tiada kejadian pencemaran udara lain yang teruk berlaku pada tahun 2013.

Selain daripada bahan pencemar PM_{10}, O_3 juga merupakan parameter pencemar yang menjadi perhatian yang terhasil akibat keadaan atmosfera dan pelepasan ekzos daripada kenderaan bermotor di bandar-bandar besar. Ini menyebabkan berlakunya beberapa hari yang tidak sihat di beberapa lokasi di Lembah Klang dan di Negeri Perak, Negeri Sembilan, Johor, Kedah dan Pulau Pinang.

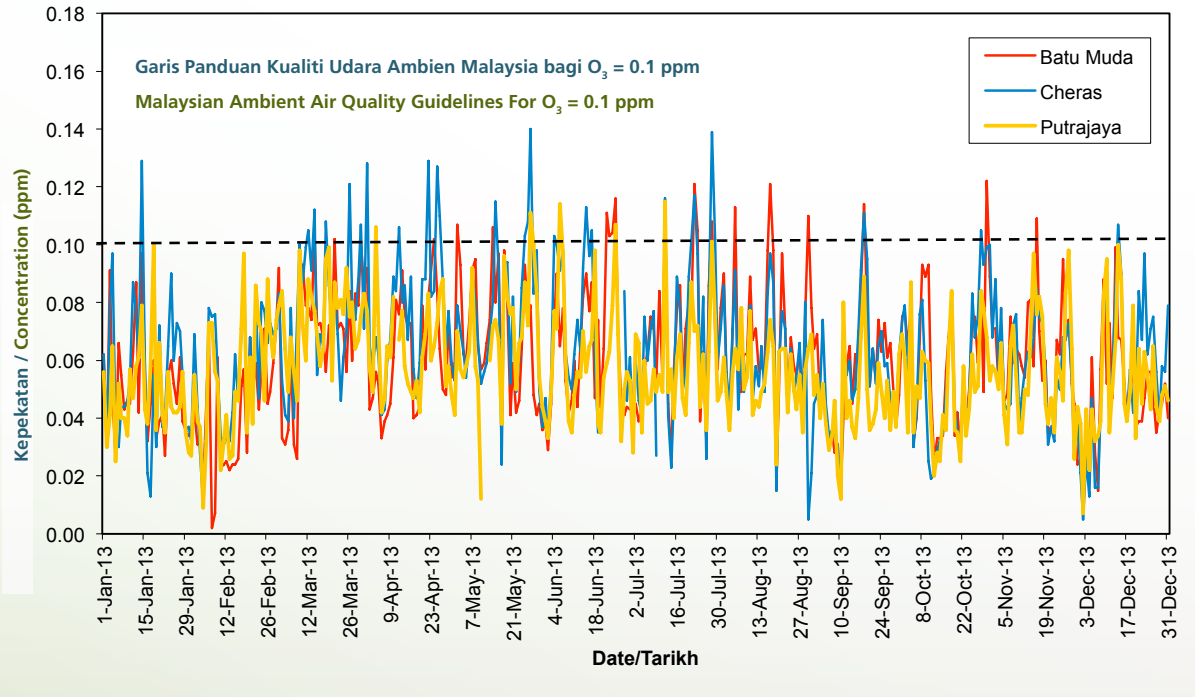
AIR QUALITY STATUS

From 15 to 27 June 2013, Malaysia had experienced short periods of severe haze episodes due to trans-boundary pollution. Most parts of Peninsular Malaysia were adversely affected when the air quality deteriorated to unhealthy and hazardous levels. The most severely affected areas in Peninsular Malaysia were Johor, Melaka and Negeri Sembilan. During the haze episodes, the highest API readings were recorded in Muar District, Johor, where it exceeded more than 500. Consequently, a haze emergency was declared by the Hon. Prime Minister on 23 June 2013, in Muar and Ledang Districts, Johor, and was subsequently lifted on 24 June 2013, after the API levels in both areas dropped to below 300, further improving visibility. Apart from this haze episode, there were no other serious air pollution incidences in 2013.

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

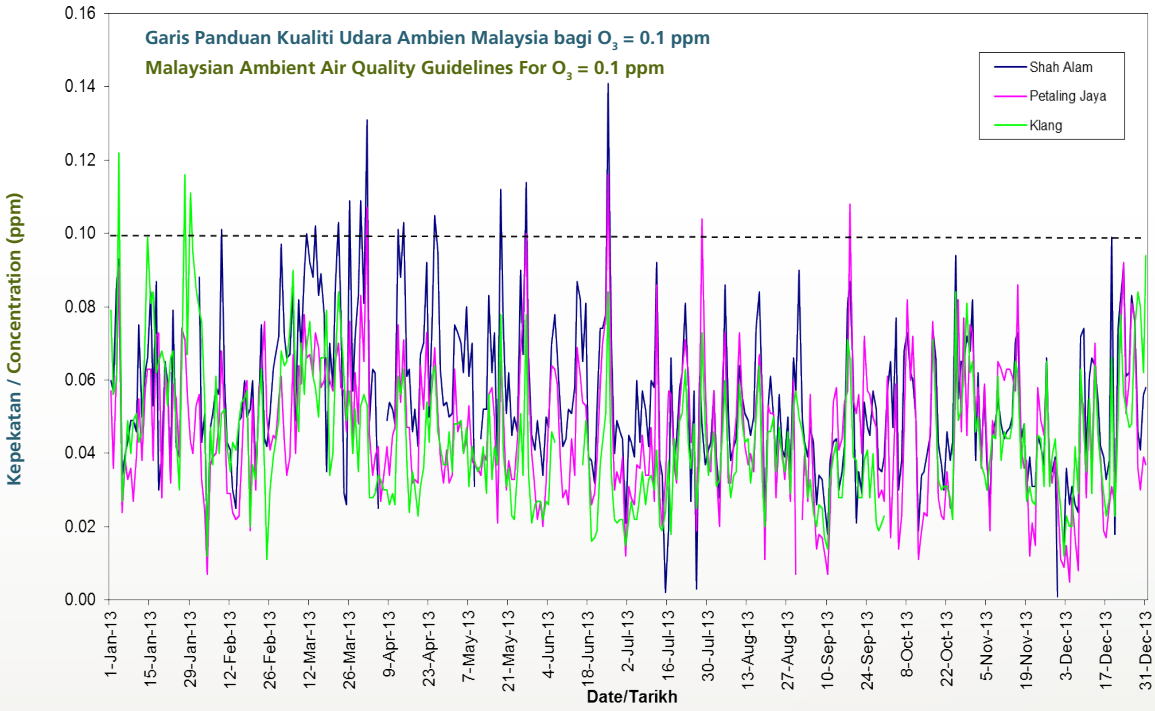
Kadangkala, kepekatan maksimum harian bagi parameter O_3 dalam tempoh 1 jam adalah melebihi Garis Panduan Kualiti Udara Ambien Malaysia terutamanya di beberapa kawasan di Lembah Klang, Perak, Negeri Sembilan dan Kedah seperti yang ditunjukkan dalam **Rajah 1.1 (a), Rajah 1.1 (b)** dan **Rajah 1.1 (c).** Keadaan ini menyebabkan beberapa hari yang tidak sihat dicatatkan di kawasan-kawasan pusat perniagaan yang tinggi kepadatan trafik.

Occasionally, the daily maximum 1-hour concentration of O_3 exceeded the Malaysian Ambient Air Quality Guidelines in 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, which created several unhealthy days, affected a few high traffic volume business areas.



Rajah 1.1 (a) Malaysia : Tren Kepekatan maksimum Harian Ozon (O_3) 1 Jam, Lembah Klang, 2013

Figure 1.1 (a) Malaysia: Trend of Daily Maximum 1- hour Concentration of Ozone (O_3), Klang Valley 2013



Rajah 1.1 (b) Malaysia : Tren Kepekatan maksimum Harian Ozon (O_3) 1 Jam, Lembah Klang, 2013
Figure 1.1 (b) Malaysia: Trend of Daily Maximum 1- hour Concentration of Ozone (O_3), Klang Valley 2013

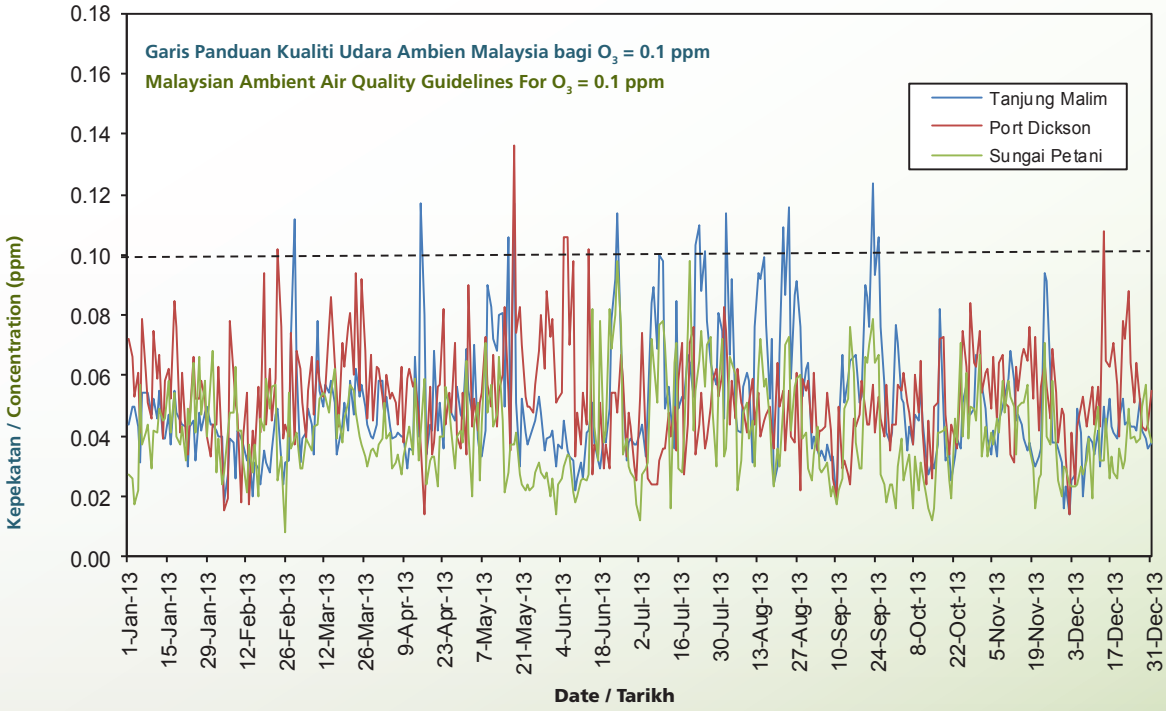
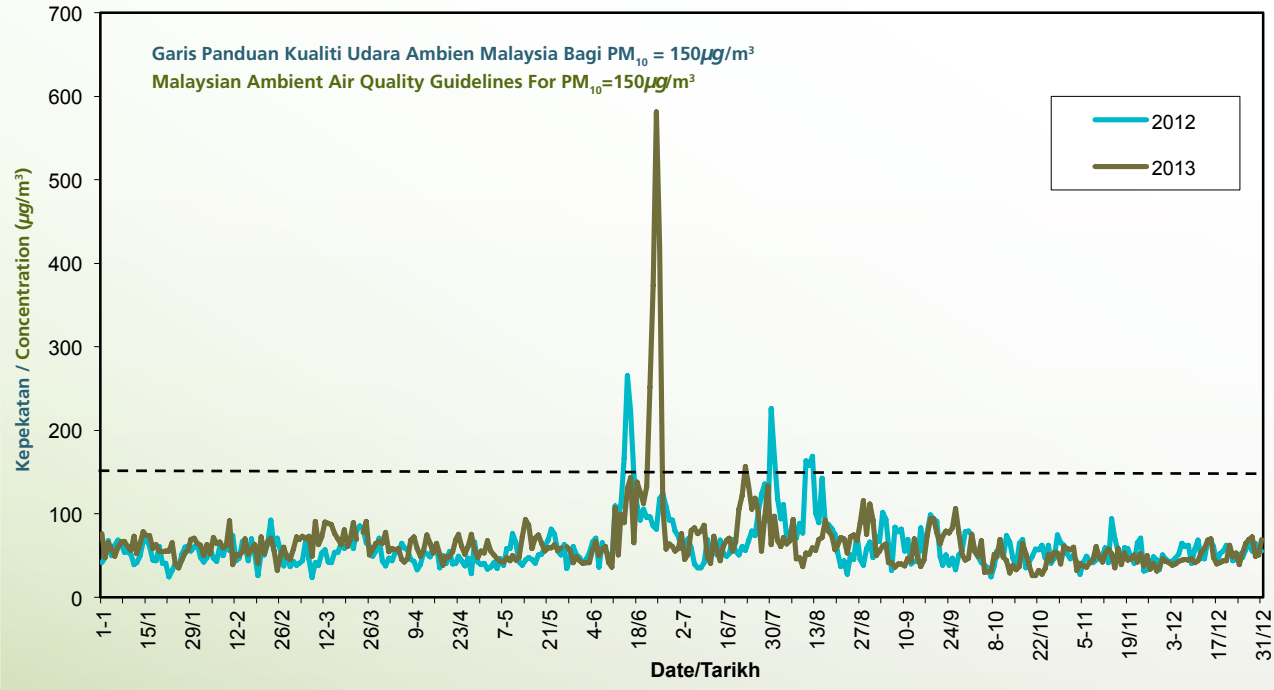


Figure 1.1 (c) Malaysia : Tren Maksimum Harian Ozon (O_3) dalam tempoh 1 jam, Tanjung Malim, Port Dickson dan Sungai Petani, 2013
Figure 1.1 (c) Malaysia : Trend of Daily Maximum 1-hour Concentration of Ozone (O_3), Tanjung Malim, Port Dickson and Sungai Petani, 2013

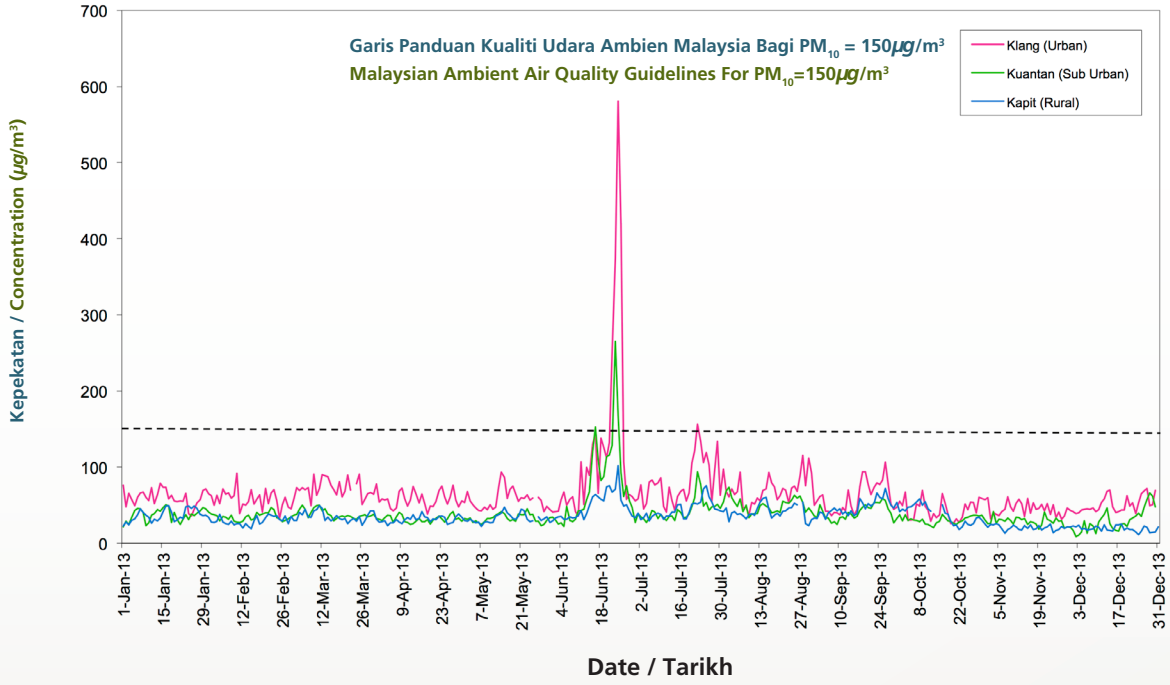
Secara keseluruhan, terdapat sedikit kemerosotan tren kualiti udara di Lembah Klang pada tahun 2013 berbanding tahun 2012 seperti yang ditunjukkan dalam **Rajah 1.1 (d)**. PM_{10} merupakan pencemar utama yang menyebabkan kualiti udara menjadi tidak sihat berikutan musim panas dan kering yang dialami semasa Monsun Barat Daya. Status kualiti udara tidak sihat di Lembah Klang sepanjang tempoh ini adalah disebabkan oleh pencemaran merentas sempadan. **Rajah 1.1 (e)** menunjukkan kepekatan harian PM_{10} bagi Klang secara perbandingan dengan beberapa stesen terpilih di kawasan-kawasan sub-bandar dan luar bandar dengan paras PM_{10} yang lebih rendah. Nilai kepekatan kumin pepejal (PM_{10}) di Klang (kawasan bandar) adalah lebih tinggi berbanding dengan kawasan-kawasan sub-bandar dan luar bandar.

Overall, in 2013, there had been a slight deterioration in the trend of air quality in the Klang Valley, as compared to the previous year, as shown in **Figure 1.1(d).** PM_{10} was the predominant pollutant that had caused unhealthy conditions during the dry period, as a result of the Southwest Monsoon. The unhealthy days in the Klang Valley during this period was due to trans-boundary pollution. **Figure 1.1(e)** shows the daily concentrations of PM_{10} for Klang, in comparison with other selected stations in sub-urban and rural areas which recorded lower levels of PM_{10}. The concentration of particulate matter (PM_{10}) in Klang (urban area) was significantly higher compared to other suburban and rural areas.



Rajah 1.1 (d) : Tren Kepekatan 24 jam bagi Kumin Pepejal (PM_{10}), Klang, 2012 dan 2013

Figure 1.1 (d) : Trend of 24-hour Concentration of Particulate Matter (PM_{10}), Klang, 2012 and 2013



Rajah 1.1 (e) : Tren Kepekatan 24 jam bagi Kumin Pepejal (PM_{10}), Klang, 2012 dan 2013

Figure 1.1 (e) : Trend of 24-hour Concentration of Particulate Matter (PM_{10}), Klang, 2012 and 2013

Status Kualiti Udara di Pantai Barat

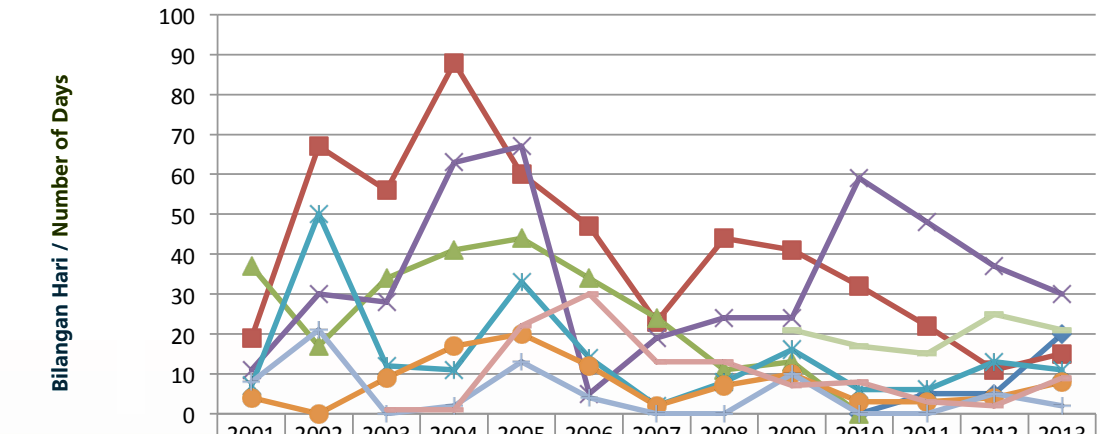
Lembah Klang

Pada tahun 2013, status kualiti udara di Lembah Klang mencatatkan 67 peratus baik, 28 peratus sederhana dan baki lima (5) peratus tidak sihat. Bilangan hari di mana status kualiti udara mencatatkan paras tidak sihat yang tertinggi adalah di Cheras, Kuala Lumpur (30 hari) **(Rajah 1.1)**. Status kualiti udara tidak sihat yang dicatatkan adalah disebabkan oleh ozon di permukaan bumi (O_3). Di Klang, status kualiti udara tidak sihat adalah sebahagian besarnya disebabkan oleh kumin pepejal (PM_{10}) akibat pencemaran merentas sempadan semasa musim Monsun Barat Daya. Status kualiti udara di Lembah Klang secara keseluruhannya ditunjukkan seperti di **Rajah 1.2.**

Air Quality Status in the West Coast

Klang Valley

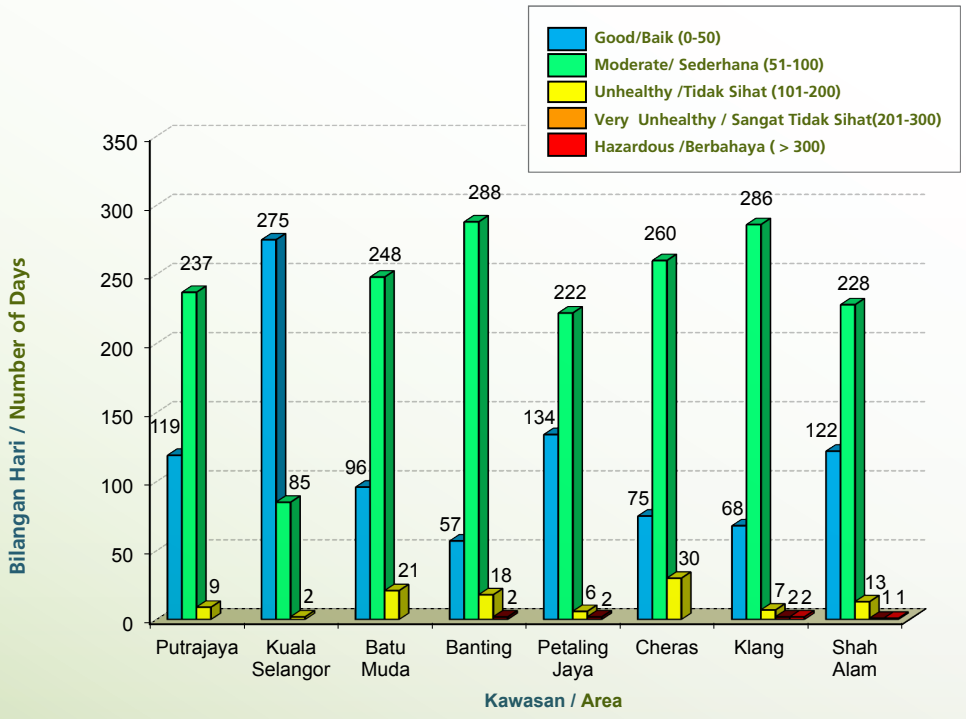
In 2013, the air quality in the Klang Valley was good for about 67 percent of the time, was moderate for about 28 percent of the time and the remaining five (5) percent recorded unhealthy levels. The highest number of unhealthy days was recorded in Cheras, Kuala Lumpur (30 days) **(Figure 1.1).** The unhealthy days recorded were due to ground level ozone (O_3). In the Klang area, the unhealthy days were caused by particulate matter (PM_{10}) mainly from trans-boundary pollution during the Southwest Monsoon. The overall air quality status in the Klang Valley is as shown in **Figure 1.2.**



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Banting										0	5	5	20
Shah Alam	19	67	56	88	60	47	23	44	41	32	22	11	15
Kajang	37	17	34	41	44	34	24	11	13	0			
Cheras	11	30	28	63	67	5	19	24	24	59	48	37	30
Klang	7	50	12	11	33	14	2	8	16	6	6	13	11
Petaling Jaya	4	0	9	17	20	12	2	7	10	3	3	4	8
Kuala Selangor	8	21	0	2	13	4	0	0	10	0	0	5	2
Putrajaya			1	1	22	30	13	13	7	8	3	2	9
Batu Muda									21	17	15	25	21

Rajah 1.1 Malaysia : Bilangan Hari Tidak Sihat, Lembah Klang, 2001-2013
Figure 1.1 Malaysia : Number of Unhealthy Days, Klang Valley, 2001 - 2013

Nota: Bacaan adalah berdasarkan IPU Maksimum Harian
Note: Reading based on daily Maximum API



Rajah 1.2 Malaysia : Lembah Klang, Status Kualiti Udara, 2013
Figure 1.2 Malaysia : Klang Valley Air Quality Status, 2013

Nota: Bacaan adalah berdasarkan IPU Maksimum Harian
Note: Reading based on daily Maximum API

Wilayah Utara

Secara keseluruhan, status kualiti udara di utara Pantai Barat Semenanjung Malaysia yang meliputi Negeri Perlis, Kedah, Negeri Pulau Pinang dan Perak adalah baik dan sederhana sepanjang masa. Walau bagaimanapun, Manjung mencatatkan satu (1) hari status kualiti udara berbahaya dan lima (5) hari status kualiti udara tidak sihat, Tanjung Malim mencatatkan 16 hari status kualiti udara tidak sihat, Taiping mencatatkan tiga (3) hari status kualiti udara tidak sihat, Sungai Petani mencatatkan satu (1) hari status kualiti udara tidak sihat, USM dan Perai masing-masing mencatatkan dua (2) hari status kualiti udara tidak sihat dan di Seberang Jaya, Tasek serta Ipoh mencatatkan empat (4) hari status kualiti udara tidak sihat. Pencemar-pencemar utama adalah ozon di permukaan bumi (O_3) dan PM_{10}. **Rajah 1.3** menunjukkan status kualiti udara keseluruhan bagi wilayah utara di Pantai Barat Semenanjung Malaysia.

Wilayah Selatan

Kualiti udara di wilayah selatan Pantai Barat Semenanjung Malaysia (Negeri Sembilan, Melaka dan Johor) adalah baik dan sederhana pada kebanyakan masa, kecuali terdapat beberapa hari yang mencatatkan status kualiti udara berbahaya iaitu di Bukit Rambai empat (4), Melaka dua (2), Muar dua (2), Pasir Gudang dua (2) dan Kota Tinggi dua (2), manakala hari yang sangat tidak sihat dicatatkan di Melaka dua (2), Muar dua (2), Pasir Gudang satu (1) dan Larkin dua (2).

Northern Region

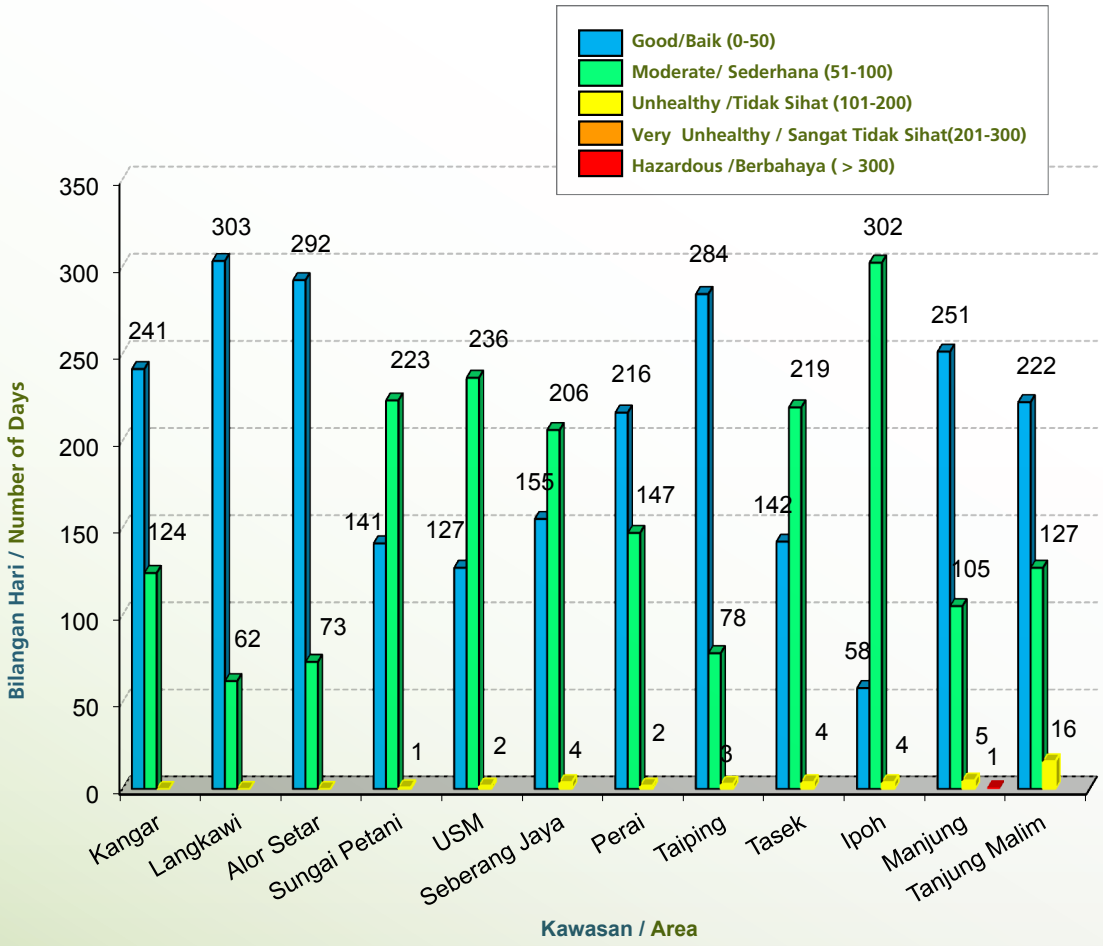
The overall air quality of the northern region, of the West Coast of Peninsular Malaysia, covering Perlis, Kedah, Pulau Pinang and Perak, were between moderate to good most of the time. However, Manjung recorded one (1) hazardous day and five (5) unhealthy days, Tanjung Malim recorded 16 unhealthy days, Taiping recorded three (3) unhealthy days, Sungai Petani recorded one (1) unhealthy day, USM and Perai recorded two (2) unhealthy days, whereas four (4) unhealthy days were recorded at Seberang Jaya, Tasek and Ipoh, respectively. The main pollutants were ground level ozone (O_3) and PM_{10}. **Figure 1.3** indicates 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 hovered between moderate to good most of the time, with the exception of a few hazardous days in Bukit Rambai (4 days), Melaka (2 days), Muar (2 days), Pasir Gudang (2 days) and Kota Tinggi (2 days). Very unhealthy days were recorded in Melaka (2 days), Muar (2 days), Pasir Gudang (1 day) and Larkin (2 days). Apart from that, unhealthy days were

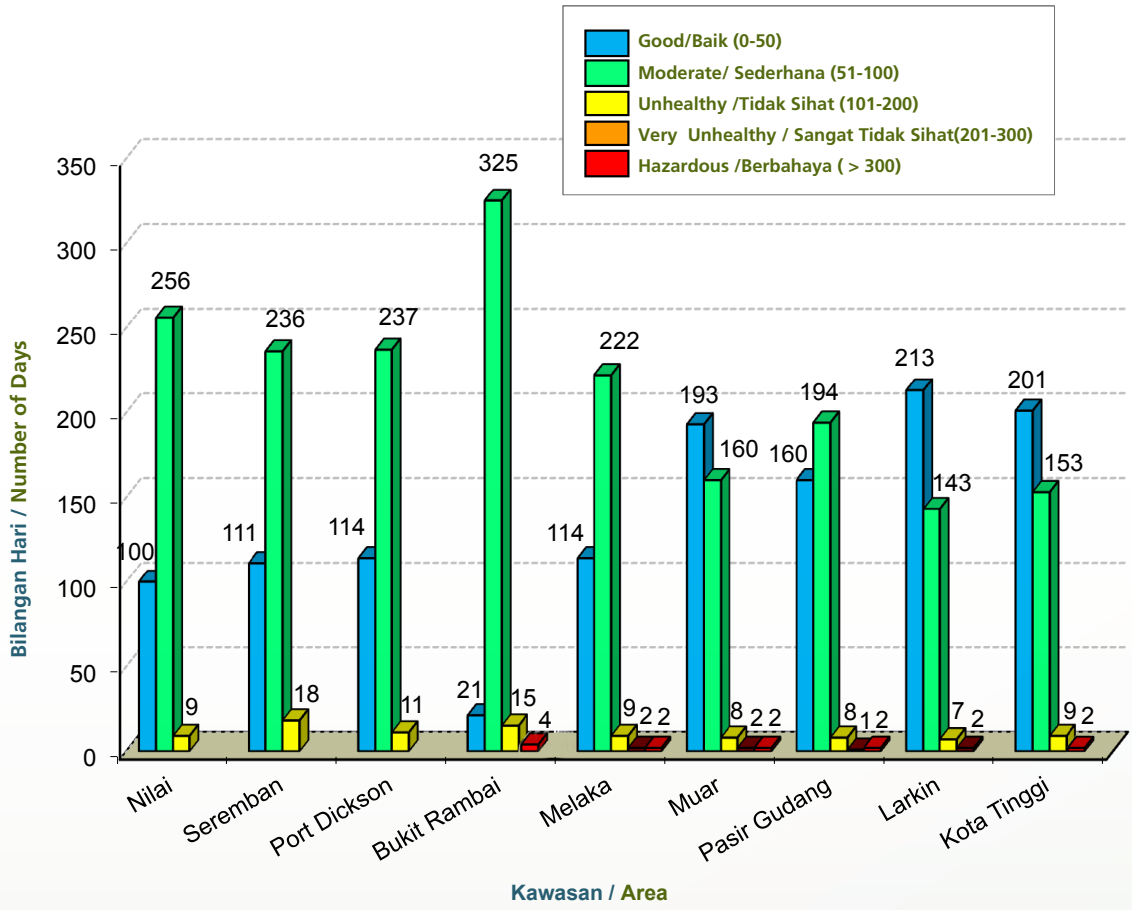
Selain daripada itu, terdapat juga hari yang mencatatkan status kualiti udara tidak sihat iaitu di Nilai sembilan (9), Seremban (18), Port Dickson (11), Bukit Rambai (15), Melaka sembilan (9), Muar lapan (8), Pasir Gudang lapan (8), Larkin tujuh (7), dan Kota Tinggi sembilan (9). Terdapat sedikit kemerosotan kualiti udara bagi wilayah selatan dengan sedikit peningkatan dari segi jumlah hari yang tidak sihat berbanding tahun 2012. Ini disebabkan oleh pencemar PM_{10} daripada pencemaran merentas sempadan. **Rajah 1.4** menunjukkan status kualiti udara secara keseluruhan bagi wilayah selatan di Pantai Barat Semenanjung Malaysia.

also recorded in Nilai (9 days), Seremban (18 days), Port Dickson (11 days), Bukit Rambai (15 days), Melaka (9 days), Muar (8 days), Pasir Gudang (8 days), Larkin (7 days), and Kota Tinggi (9 days). A slight deterioration was seen in the overall air quality for the southern region with a slight increase in the number of unhealthy days compared to 2012. This is due to high levels of PM_{10} caused by trans-boundary pollution. **Figure 1.4** shows the overall air quality status for southern region of the West Coast of Peninsular Malaysia.



Rajah 1.3 Malaysia : Status Kualiti Udara, Wilayah Utara Pantai Barat Semenanjung Malaysia, 2013
Figure 1.3 Malaysia : Air Quality Status, Northern Region of The West Coast Peninsular Malaysia, 2013

Nota: Bacaan adalah berdasarkan IPU Maksimum Harian
Note: Reading based on daily Maximum API



Rajah 1.4 Malaysia : Status Kualiti Udara, Wilayah Selatan Pantai Barat Semenanjung Malaysia, 2013

Figure 1.4 Malaysia : Air Quality Status, Southern Region of The West Coast Peninsular Malaysia, 2013

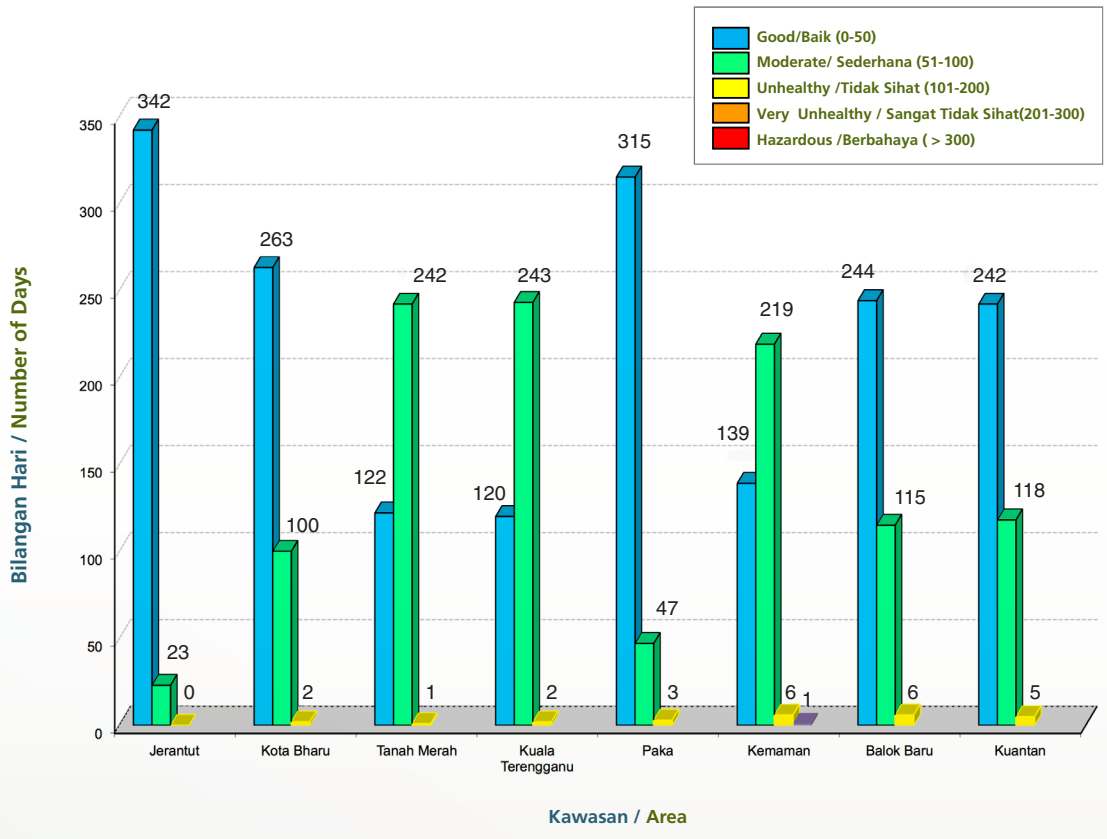
Nota: Bacaan adalah berdasarkan IPU Maksimum Harian
Note: Reading based on daily Maximum API

Status Kualiti Udara di Pantai Timur

Kualiti udara di Pantai Timur Semenanjung Malaysia (Pahang, Terengganu, Kelantan dan timur Johor) kekal berstatus baik dan sederhana pada kebanyakan masa, kecuali terdapat beberapa hari yang mencatatkan status kualiti udara tidak sihat semasa musim kering iaitu pada bulan Jun hingga September iaitu di Jerantut (18), Kota Bharu dua (2), Tanah Merah satu (1), Kuala Terengganu dua (2), Paka tiga (3), Kemaman enam (6), Balok Baru enam (6) dan Kuantan lima (5). Kemaman, Terengganu mencatatkan satu (1) hari status kualiti udara berbahaya iaitu

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 moderate to good most of the time, with the exception of a few unhealthy days during the dry period, from June to September. The readings shown were Jerantut (18 days), Kota Bharu (2 days), Tanah Merah (1 day), Kuala Terengganu (2 days), Paka (3 days), Kemaman (6 days), Balok Baru (6 days) and Kuantan (5 days). One (1) hazardous day was also recorded in Kemaman, Terengganu, in June 2013. The overall air quality status in



Rajah 1.5 Malaysia : Status Kualiti Udara, Pantai Timur Semenanjung Malaysia, 2013
Figure 1.5 Malaysia : Air Quality Status, East Coast Peninsular Malaysia, 2013

Nota: Bacaan adalah berdasarkan IPU Maksimum Harian
Note: Reading based on daily Maximum API

pada bulan Jun 2013. Status kualiti udara di Pantai Timur Semenanjung Malaysia secara keseluruhan adalah seperti di **Rajah1.5**

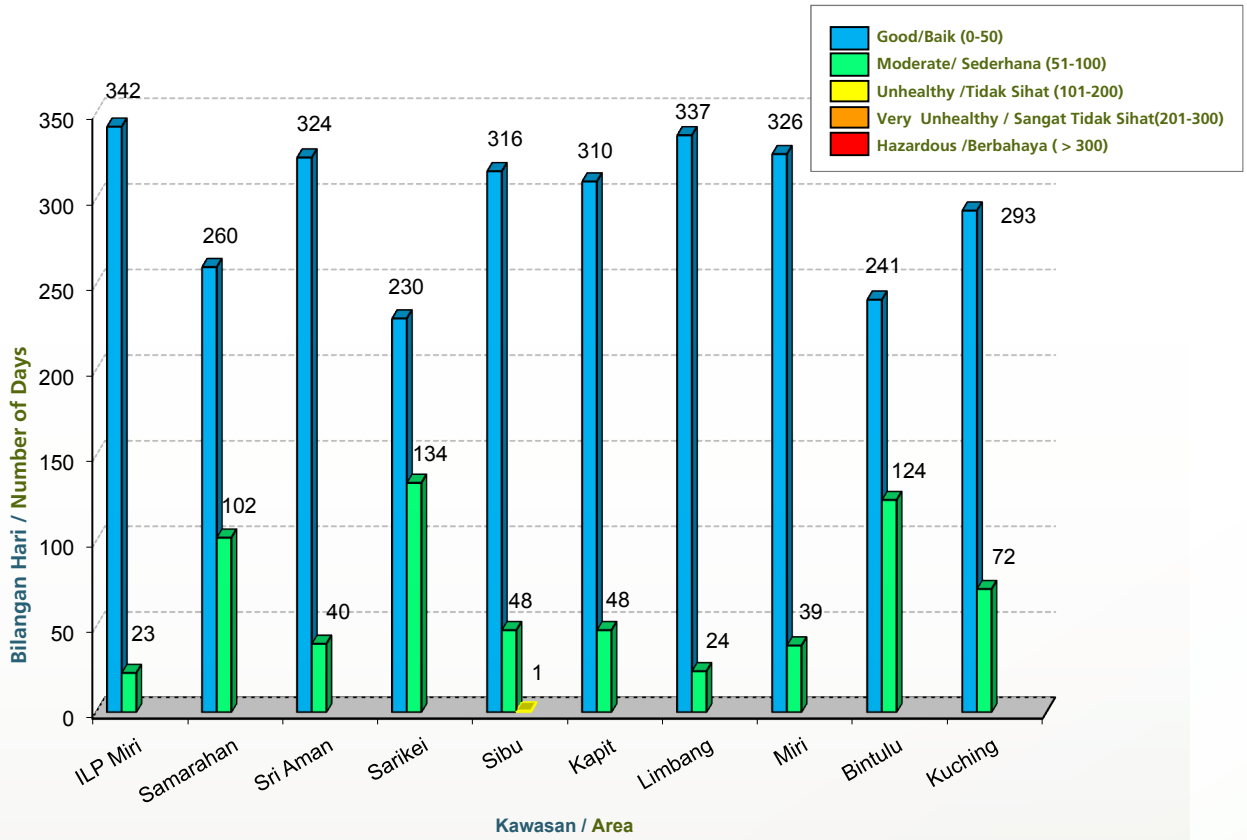
Status Kualiti Udara di Sabah, Labuan Sarawak Sarawak

Kualiti udara di Sabah, Labuan dan Sarawak kekal berstatus baik dan sederhana di kebanyakan masa. Hanya Sibu, Sarawak dan Keningau, Sabah masing-masing merekodkan satu (1) hari status kualiti udara tidak sihat. Status kualiti udara di Sarawak secara keseluruhan ditunjukkan dalam **Rajah 1.6** dan di Sabah dan Labuan ditunjukkan dalam **Rajah 1.7.**

the East Coast of Peninsular Malaysia is as shown in **Figure 1.5.**

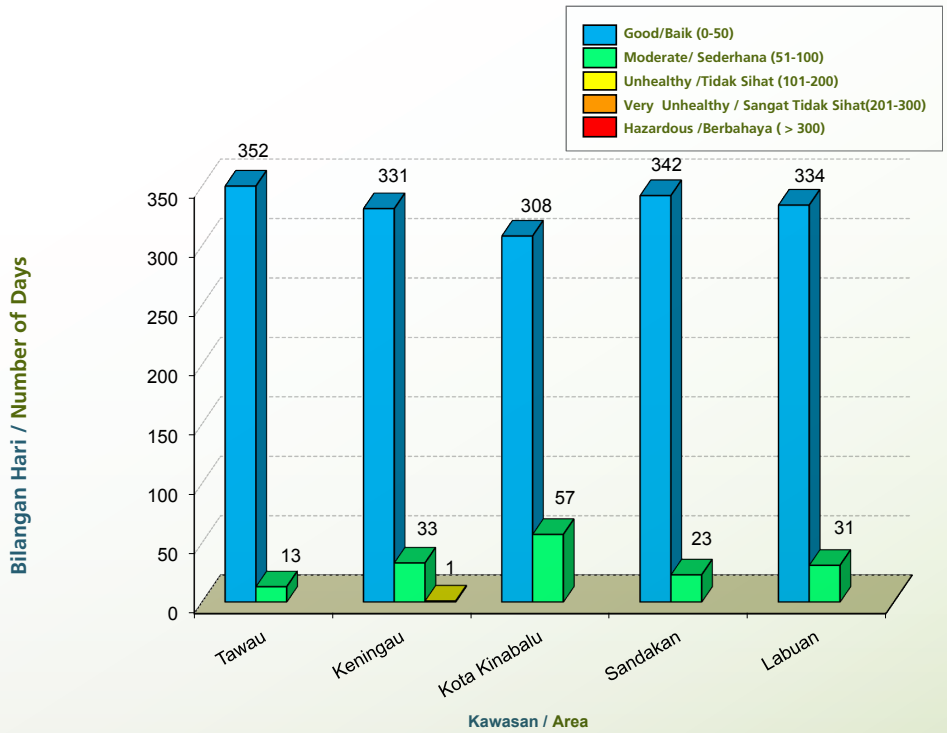
Air Quality Status in Sabah, Labuan and Sarawak

The air quality in Sabah, Labuan and Sarawak remained between moderate to good most of the time. Only Sibu, Sarawak, and Keningau, Sabah, recorded one (1) unhealthy day, respectively. The overall air quality status in Sarawak is as shown in **Figure 1.6** while **Figure 1.7** shows the overall air quality in Sabah and Labuan.



Rajah 1.6 Malaysia : Status Kualiti Udara, Sarawak, 2013
Figure 1.6 Malaysia : Air Quality Status, Sarawak, 2013

Nota: Bacaan adalah berdasarkan IPU Maksimum Harian
Note: Reading based on daily Maximum API



Rajah 1.7 Malaysia : Status Kualiti Udara, Sabah dan Labuan, 2013
Figure 1.7 Malaysia : Air Quality Status, Sabah and Labuan, 2013

Nota: Bacaan adalah berdasarkan IPU Maksimum Harian
Note: Reading based on daily Maximum API

TREN KUALITI UDARA

Lima (5) pencemar udara iaitu kumin pepejal (PM_{10}), ozon permukaan bumi (O_3), sulfur dioksida (SO_2), nitrogen dioksida (NO_2) dan karbon monoksida (CO) dipantau secara berterusan di 52 buah lokasi. Tren kualiti udara dari tahun 1999 hingga 2013 ditentukan dengan mengambilkira purata data kualiti udara tahunan daripada stesen-stesen pengawasan dan merujuk kepada Garis Panduan Kualiti Udara Ambien Malaysia seperti yang ditunjukkan dalam **Jadual 1.2.**

AIR QUALITY TREND

Five (5) air pollutants consisting of particulate matter (PM_{10}), ozone (O_3), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and carbon monoxide (CO) were monitored continuously at 52 locations. The air quality trend for the period of 1999 to 2013 was computed by taking the yearly average measurement from the monitoring sites and cross-referencing with Malaysia Ambient Air Quality Guidelines as shown in **Table 1.2.**

Bahan Pencemar / Pollutant	Masa Purata / Averaging Time	Garis Panduan Malaysia / Malaysia Guidelines	
		ppm	(μg/m³)
Ozon / Ozone	1 Hour	0.10	200
	8 Hours	0.06	120
Karbon Monoksida / Carbon Monoxide	1 Hour	30.0	35**
	8 Hours	9.0	10**
Nitrogen Dioksida / Nitrogen Dioxide	1 Hour	0.17	320
	24 hours	0.04	
Sulfur Dioksida / Sulphur Dioxide	1 hour	0.13	350
	24 Hours	0.04	105
Pepejal Terampai (PM_{10}) / Particulate Matter (PM_{10})	24 Hours		150
	12 Months		50
Jumlah Pepejal Terampai / Total Suspended Particulate (TSP)	24 Hours		260
	12 Months		90
Plumbum / Lead	3 Months		1.5

Jadual 1.2 Malaysia : Garis Panduan Kualiti Udara Ambien Malaysia

Table 1.2 Malaysia : Ambient Air Quality Guidelines

*Nota / Note: ** mg/m³*

Kumin Pepejal (PM_{10})

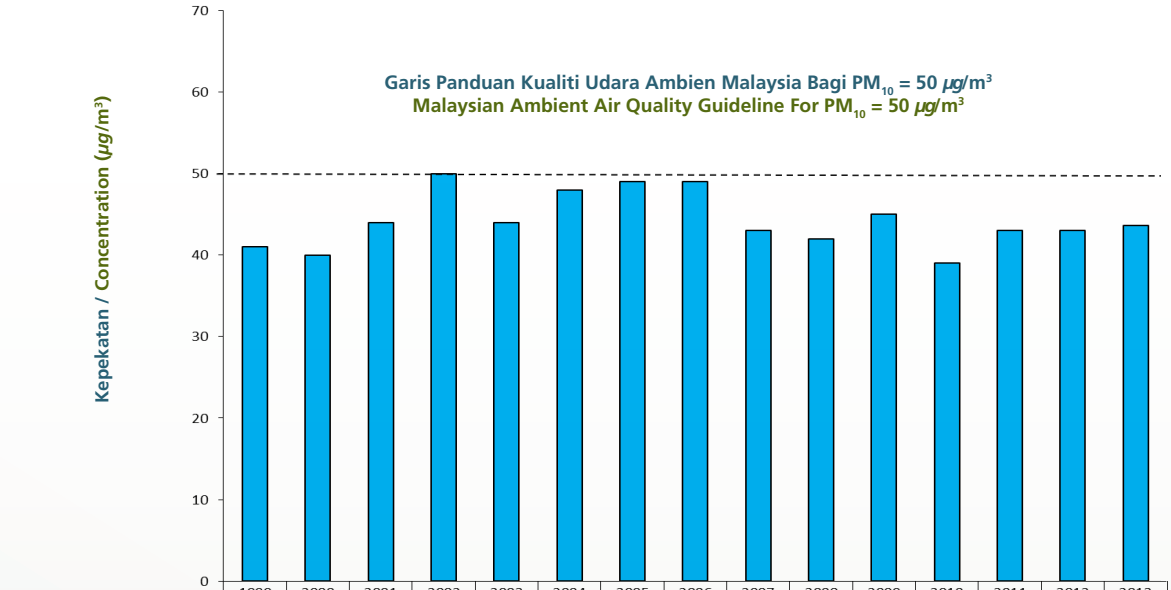
Pada tahun 2013, nilai purata tahunan PM_{10} dalam udara ambien adalah 44 $\mu g/m^3$ iaitu di bawah had yang ditetapkan dalam Garis Panduan Kualiti Udara Ambien Malaysia iaitu sebanyak 50 $\mu g/m^3$. Kepekatan PM_{10} bagi tahun 2013 menunjukkan sedikit peningkatan iaitu sebanyak dua (2) peratus berbanding tahun 2012. Kejadian kebakaran tanah gambut dalam negara dan jerebu merentas sempadan telah menyumbang kepada bacaan PM_{10} yang tinggi dicatatkan di beberapa kawasan di Johor, Melaka dan Negeri Sembilan dari bulan Jun hingga September 2013.

Tren purata tahunan kepekatan PM_{10} dalam udara ambien antara tahun 1999 hingga 2013 didapati mematuhi Garis Panduan Kualiti Udara Ambien Malaysia seperti yang ditunjukkan dalam **Rajah 1.8**. Berdasarkan kategori guna tanah, nilai kepekatan PM_{10} adalah mematuhi Garis Panduan Kualiti Udara Ambien Malaysia seperti yang ditunjukkan dalam **Rajah 1.8 (a).**

Particulate Matter (PM_{10})

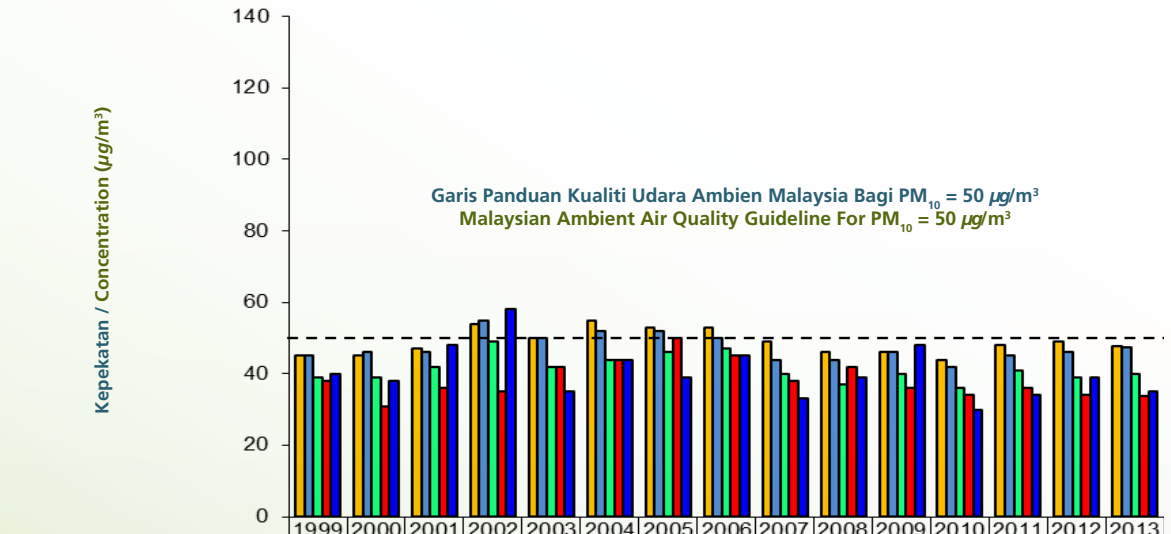
In 2013, the annual average value of PM_{10} in the ambient air was 44 $\mu g/m^3$, which is below the Malaysian Ambient Air Quality Guidelines value of 50 $\mu g/m^3$. The concentrations for 2013 increased slightly by two (2) percent compared to 2012. Incidences of local peat land fires and trans-boundary smoke haze had contributed to the higher PM_{10} recorded intermittently in several areas in Johor, Melaka and Negeri Sembilan from June to September 2013.

The trend of the annual average levels of PM_{10} concentration in the ambient air between 1999 and 2013 is in accordance with the Malaysian Ambient Air Quality Guidelines as shown in **Figure 1.8.** Based on land use categories, PM_{10} concentration was in compliance with the Malaysian Ambient Air Quality Guidelines as shown in **Figure 1.8(a).**



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Concentration/Kepekatan	41	40	44	50	44	48	49	49	43	42	45	39	43	43	44
Number of Sites/ Bilangan Lokasi	45	50	50	50	51	51	51	51	51	51	51	52	52	52	52

Rajah 1.8 Malaysia: Purata Kepekatan Tahunan Kumin Pepejal (PM_{10}) 1999 -2013
Figure 1.8 Malaysia: Annual Average Concentration of Particulate Matter (PM_{10}) 1999 -2013



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Industrial/Industri	45	45	47	54	50	55	53	53	49	46	46	44	48	49	48
Urban/Bandar	45	46	46	55	50	52	52	50	44	44	46	42	45	46	48
Sub Urban/Luar Bandar	39	39	42	49	42	44	46	47	40	37	40	36	41	39	40
Background	38	31	36	35	42	44	50	45	38	42	36	34	36	34	34
Rural	40	38	48	58	35	44	39	45	33	39	48	30	34	39	35

Rajah 1.8(a) Malaysia: Purata Kepekatan Tahunan Kumin Pepejal (PM_{10}) Mengikut Guna Tanah, 1999 - 2013
Figure 1.8(a) Malaysia: Annual Average Concentration of Particulate Matter (PM_{10}) by Land Use, 1999 - 2013

Ozon Permukaan Bumi (O_3)

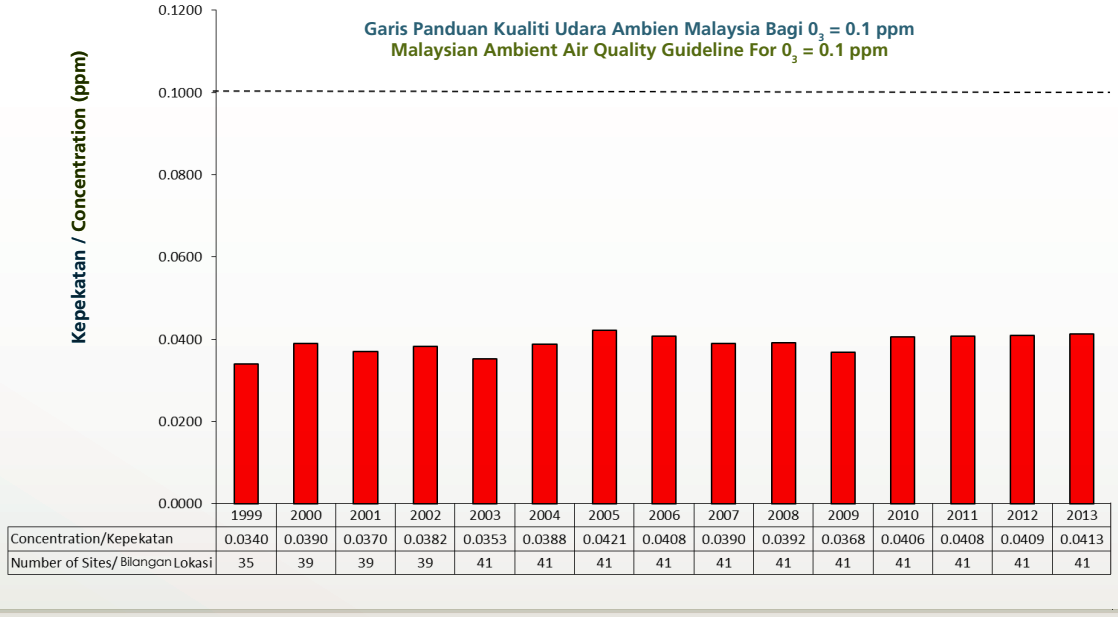
Pada tahun 2013, purata tahunan kepekatan maksimum harian ozon adalah meningkat sebanyak dua(2) peratus berbanding tahun 2012. Walau bagaimanapun, tren keseluruhan purata tahunan kepekatan maksimum ozon dalam udara ambien dari tahun 1999 hingga 2013 adalah mematuhi had sebanyak 0.1 ppm seperti yang ditetapkan dalam Garis Panduan Kualiti Udara Ambien Malaysia dan tren tersebut adalah seperti yang ditunjukkan dalam **Rajah 1.9.**

Rajah 1.9(a) menunjukkan kepekatan ozon untuk pelbagai kategori guna tanah dari tahun 1999 hingga 2013. Kawasan bandar mencatatkan bacaan ozon lebih tinggi disebabkan oleh jumlah trafik yang lebih tinggi dan keadaan atmosfera yang kondusif menyebabkan pembentukan ozon. Pencemaran ozon juga ketara di beberapa kawasan bandar dan sub-bandar disebabkan oleh pergerakan angin yang membawa pencemar ozon yang terhasil daripada tindakbalas oksid-oksid nitrogen (NOx) dan sebatian organik meruap (VOC) daripada kenderaan bermotor dan industri.

Ground Level Ozone (O_3)

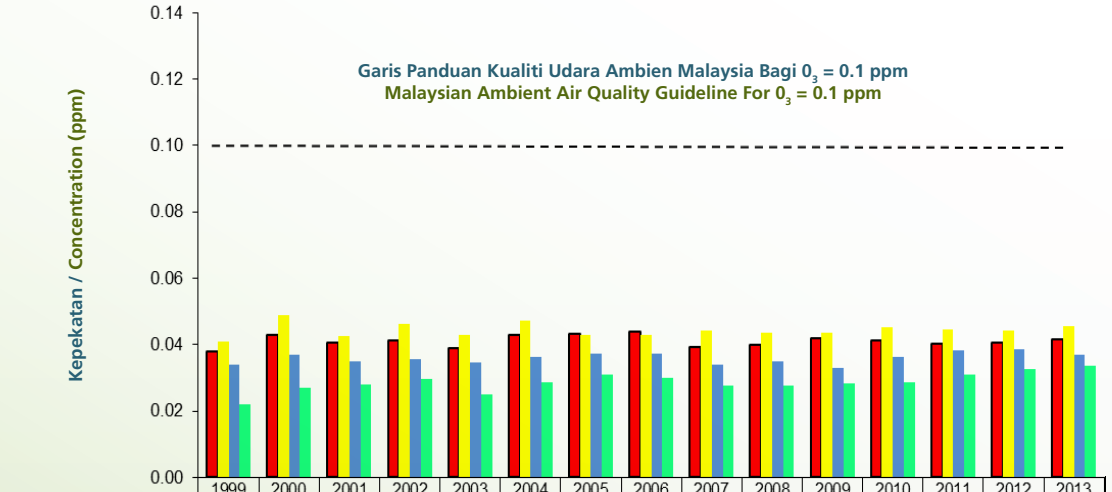
In 2013, the annual average daily maximum one-hour ozone concentrations increased slightly by two (2) percent compared to 2012. However, the overall trend on the annual average daily maximum one-hour ozone concentrations in ambient air from 1999 to 2013 were well below the limit of 0.1 ppm as stipulated in the Malaysian Ambient Quality Guidelines and the trend is as shown in **Figure 1.9.**

Figure 1.9(a) shows the ozone concentration for various land use categories between 1999 and 2013. Urban areas recorded higher levels of ozone due to higher traffic volume and conducive atmospheric conditions, resulting in its formation. Ozone pollution was also dominant in some rural and sub urban areas due to downwind effect transporting ozone pollution from the sources of ozone precursors namely nitrogen oxides (NOx) and volatile organic compound (VOC) emitted from motor vehicles and industries.



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Concentration/Kepekatan	0.0340	0.0390	0.0370	0.0382	0.0353	0.0388	0.0421	0.0408	0.0390	0.0392	0.0368	0.0406	0.0408	0.0409	0.0413
Number of Sites/ Bilangan Lokasi	35	39	39	39	41	41	41	41	41	41	41	41	41	41	41

Rajah 1.9 Malaysia: Purata Kepekatan Tahunan Ozon (O_3)1999 -2013
Figure 1.9 Malaysia: Annual Average Concentration of Ozone (O_3)1999 -2013



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Industrial/Industri	0.0380	0.0430	0.0405	0.0413	0.0389	0.0429	0.0431	0.0440	0.0391	0.0399	0.0418	0.0412	0.0401	0.0407	0.0417
Urban/Bandar	0.0410	0.0490	0.0426	0.0461	0.0428	0.0471	0.0428	0.0428	0.0441	0.0435	0.0437	0.0453	0.0447	0.0441	0.0457
Sub Urban/Luar Bandar	0.0340	0.0370	0.0348	0.0355	0.0345	0.0363	0.0373	0.0371	0.0341	0.0351	0.0331	0.0364	0.0383	0.0386	0.0370
Background	0.0220	0.0270	0.0279	0.0298	0.0250	0.0287	0.0311	0.0300	0.0277	0.0278	0.0284	0.0287	0.0308	0.0327	0.0335

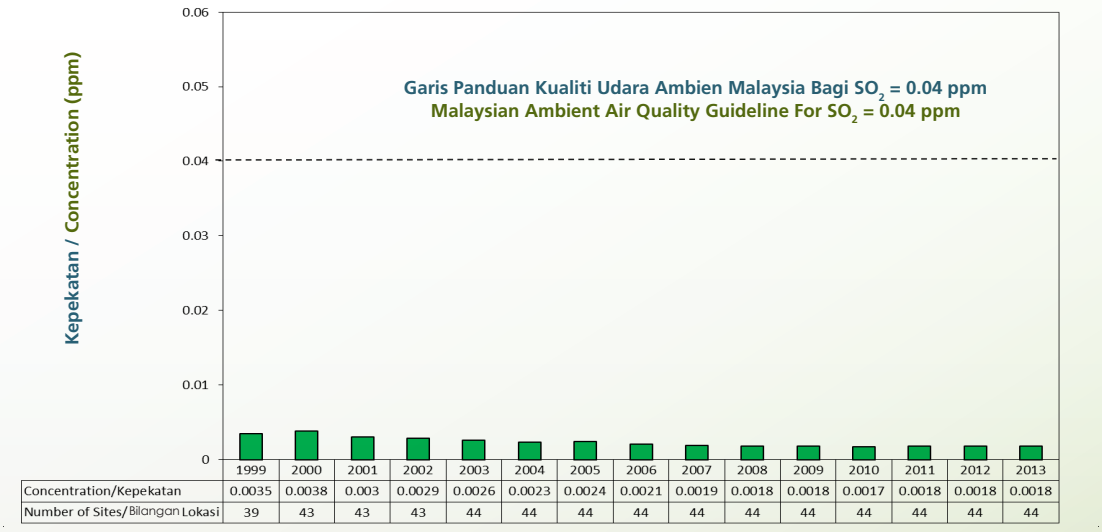
Rajah 1.9(a) Malaysia: Purata Kepekatan Tahunan Ozon (O_3)1999 -2013
Figure 1.9(a) Malaysia: Annual Average Concentration of Ozone (O_3)1999 -2013

Sulfur Dioksida (SO_2)

Secara umumnya, purata kepekatan tahunan SO_2 menunjukkan tren penurunan dari tahun 1999 hingga 2013 **(Rajah 1.10)** dan ia adalah jauh di bawah had sebanyak 0.04 ppm seperti yang ditetapkan dalam Garis Panduan Kualiti Udara Ambien Malaysia. Ini adalah disebabkan oleh penggunaan bahan api berkualiti EURO-2M yang lebih baik di negara ini bermula dari bulan September 2009 dan penguatkuasaan yang lebih ketat oleh JAS serta penggunaan gas asli secara meluas dalam proses industri dan kegunaan kenderaan. **Rajah 1.10 (a)** menunjukkan kepekatan purata tahunan bagi sulfur dioksida mengikut kategori guna tanah.

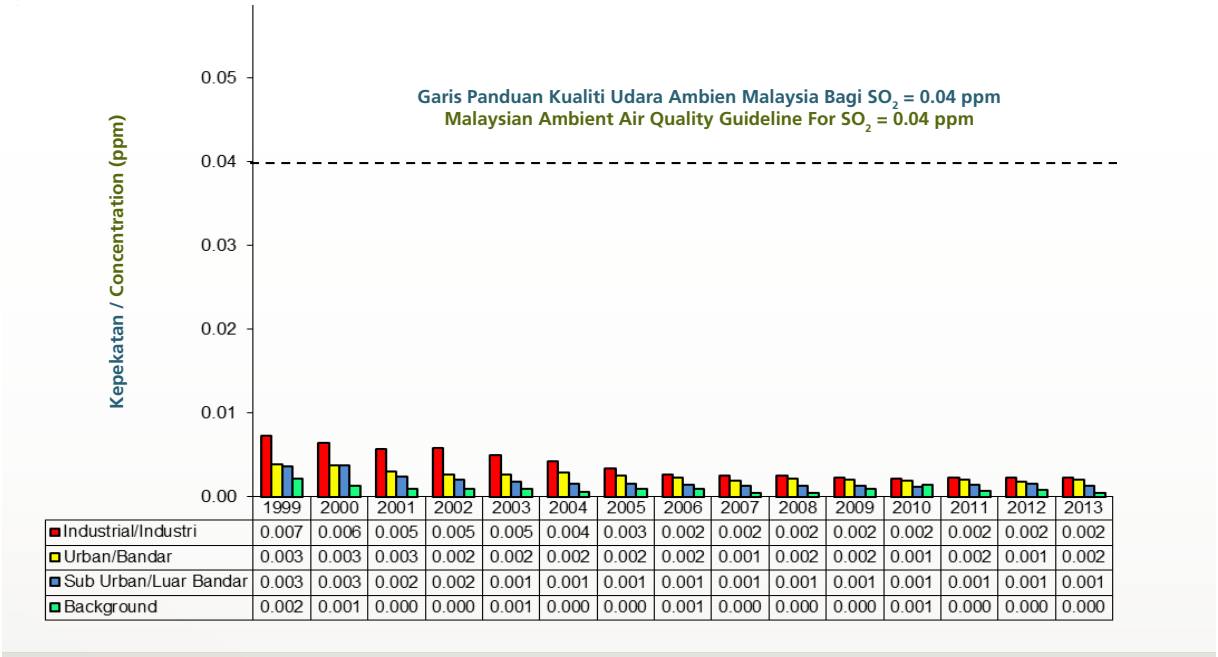
Sulphur Dioxide (SO_2)

Generally, the annual average SO_2 concentration shows a declining trend between 1999 and 2013 **(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 DOE as well as the wide use of natural gas for industrial combustion process and vehicles. **Figure 1.10(a)** shows the annual average concentrations of sulphur dioxide coming from different categories of land use.



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Concentration/Kepekatan	0.0035	0.0038	0.003	0.0029	0.0026	0.0023	0.0024	0.0021	0.0019	0.0018	0.0018	0.0017	0.0018	0.0018	0.0018
Number of Sites/Bilangan Lokasi	39	43	43	43	44	44	44	44	44	44	44	44	44	44	44

Rajah 1.10 Malaysia: Purata Kepekatan Tahunan Sulfur Dioksida (SO_2), 1999 - 2013
Figure 1.10 Malaysia: Annual Average Concentration of Sulphur Dioxide (SO_2), 1999 - 2013



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Industrial/Industri	0.007	0.006	0.005	0.005	0.005	0.004	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Urban/Bandar	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.001	0.002	0.001	0.002
Sub Urban/Luar Bandar	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Background	0.002	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000

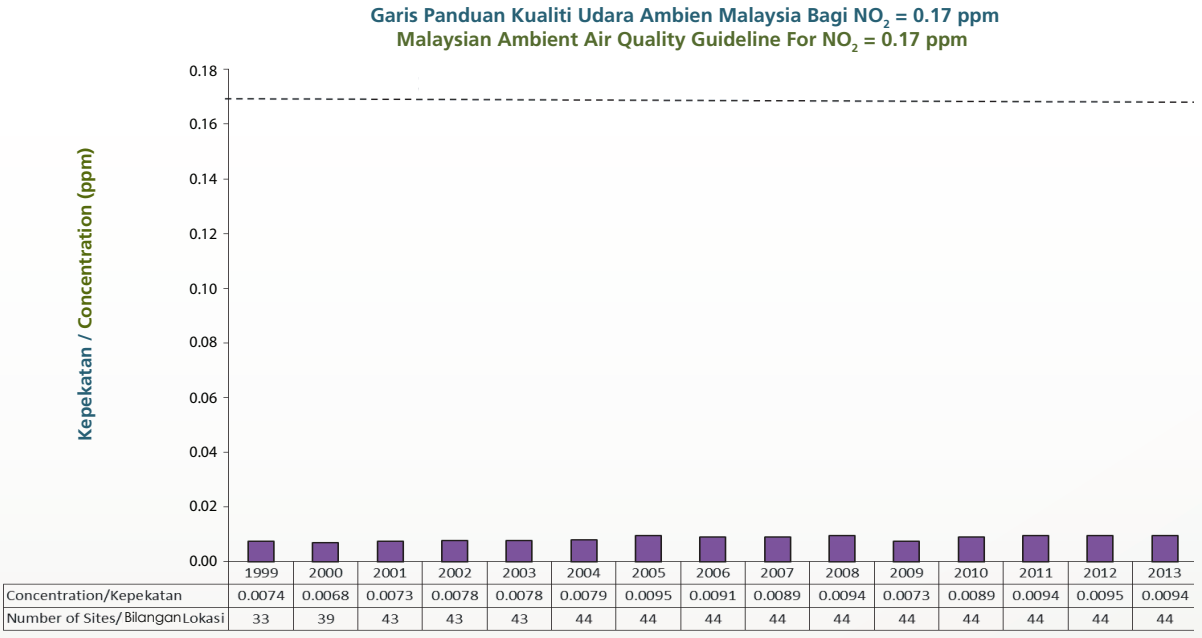
Rajah 1.10(a) Malaysia: Purata Kepekatan Tahunan Sulfur Dioksida Mengikut Guna Tanah (SO_2), 1999 - 2013
Figure 1.10(a) Malaysia: Annual Average Concentration of Sulphur Dioxide (SO_2) by Land Use, 1999 - 2013

Nitrogen Dioksida (NO_2)

Pada tahun 2013, tiada sebarang perubahan yang ketara bagi NO_2 berbanding tahun 2012. Kepekatan NO_2 kekal tinggi di kawasan bandar dan perindustrian disebabkan oleh peningkatan yang ketara dalam bilangan kenderaan bermotor dan proses pembakaran. Anggaran beban pelepasan NO_2 menunjukkan sebanyak 61% adalah daripada loji janakuasa, 26% daripada pelepasan kenderaan bermotor, 6% daripada industri dan 7% daripada lain-lain sumber. Kepekatan purata tahunan NO_2 dalam udara ambien dari tahun 1999 hingga 2013 adalah stabil dan jauh berada di bawah had yang ditetapkan dalam Garis Panduan Kualiti Udara Ambien Malaysia. **(Rajah 1.11 dan Rajah 1.11 (a))**

Nitrogen Dioxide (NO_2)

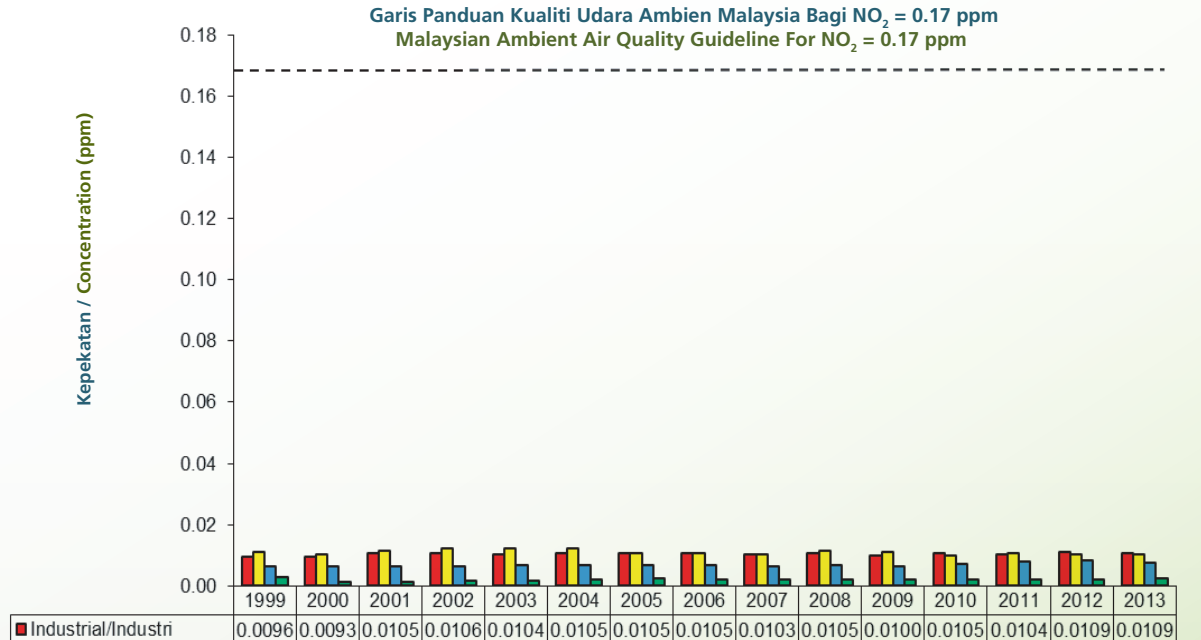
In 2013, there was no significant change of NO_2 concentration compared to the 2012 levels. The NO_2 concentrations remain high in urban and industrial areas largely due to a significant increase in the number of motor vehicles and combustion processes. Estimates on NO_2 emission load indicate 61% was from power plants while 26% from motor vehicles, 6% from industries and 7% from other sources. The annual average concentration of NO_2 in the ambient air from 1999 to 2013 remains almost constant and well below the Malaysia Ambient Air Quality Guidelines. **(Figure 1.11** and **Figure 1.11(a))**



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Concentration/Kepekatan	0.0074	0.0068	0.0073	0.0078	0.0078	0.0079	0.0095	0.0091	0.0089	0.0094	0.0073	0.0089	0.0094	0.0095	0.0094
Number of Sites/ Bilangan Lokasi	33	39	43	43	43	44	44	44	44	44	44	44	44	44	44

Rajah 1.11 Malaysia: Purata Kepekatan Tahunan Nitrogen Dioksida (NO_2), 1999 - 2013

Figure 1.11 Malaysia: Annual Average Concentration of Nitrogen Dioxide (NO_2), 1999 - 2013



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Industrial/Industri	0.0096	0.0093	0.0105	0.0106	0.0104	0.0105	0.0105	0.0105	0.0103	0.0105	0.0100	0.0105	0.0104	0.0109	0.0109
Urban/Bandar	0.0112	0.0104	0.0113	0.0122	0.0123	0.0122	0.0106	0.0105	0.0104	0.0115	0.0110	0.0098	0.0105	0.0101	0.0103
Sub Urban/Luar Bandar	0.0062	0.0062	0.0062	0.0065	0.0066	0.0068	0.0069	0.0066	0.0065	0.0066	0.0063	0.0073	0.0081	0.0083	0.0077
Background	0.0030	0.0014	0.0013	0.0018	0.0017	0.0020	0.0026	0.0020	0.0022	0.0020	0.0020	0.0019	0.0021	0.0022	0.0023

Rajah 1.11(a) Malaysia: Purata Kepekatan Tahunan Nitrogen Dioksida (NO_2), 1999 - 2013

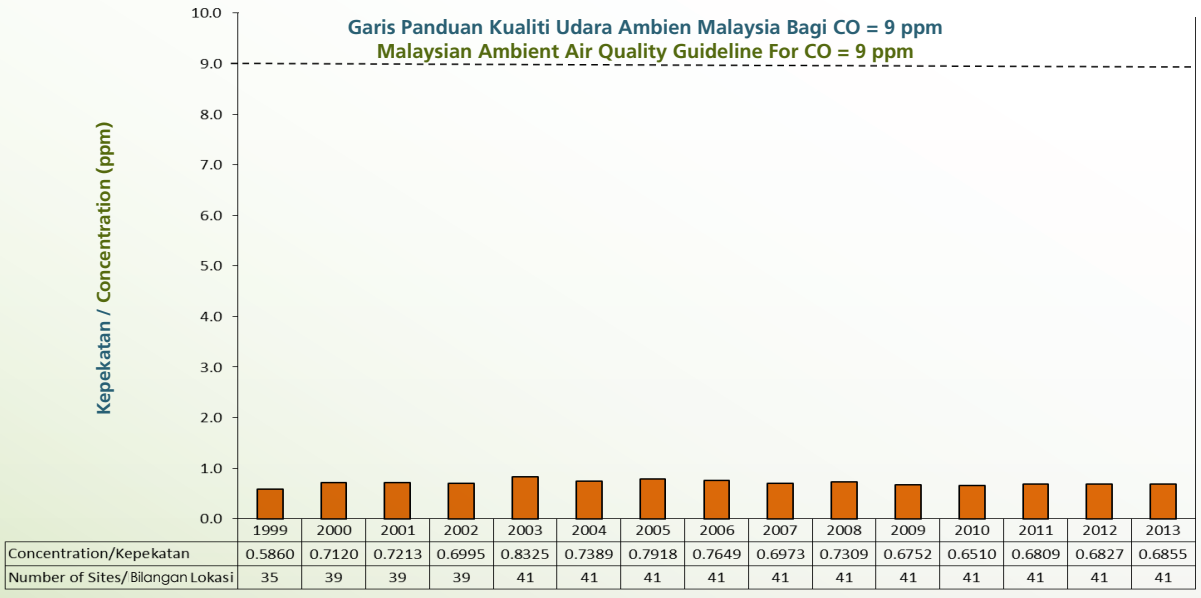
Figure 1.11(a) Malaysia: Annual Average Concentration of Nitrogen Dioxide (NO_2), 1999 - 2013

Karbon Monoksida (CO)

Terdapat sedikit peningkatan iaitu sebanyak 0.4% tahap kepekatan CO pada tahun 2013 berbanding dengan tahun 2012. Walau bagaimanapun, tren kepekatan CO dari tahun 1999 hingga 2013 adalah stabil. Tahap kepekatan yang dicatatkan juga mematuhi Garis Panduan Kualiti Udara Ambien Malaysia **(Rajah 1.12).** Di kawasan bandar, kepekatan CO adalah lebih tinggi yang berpunca daripada pelepasan kenderaan bermotor dengan menyumbang sebanyak 95% daripada beban pelepasan CO pada tahun 2013. **Rajah 1.12 (a)** menunjukkan kepekatan CO untuk pelbagai kategori guna tanah.

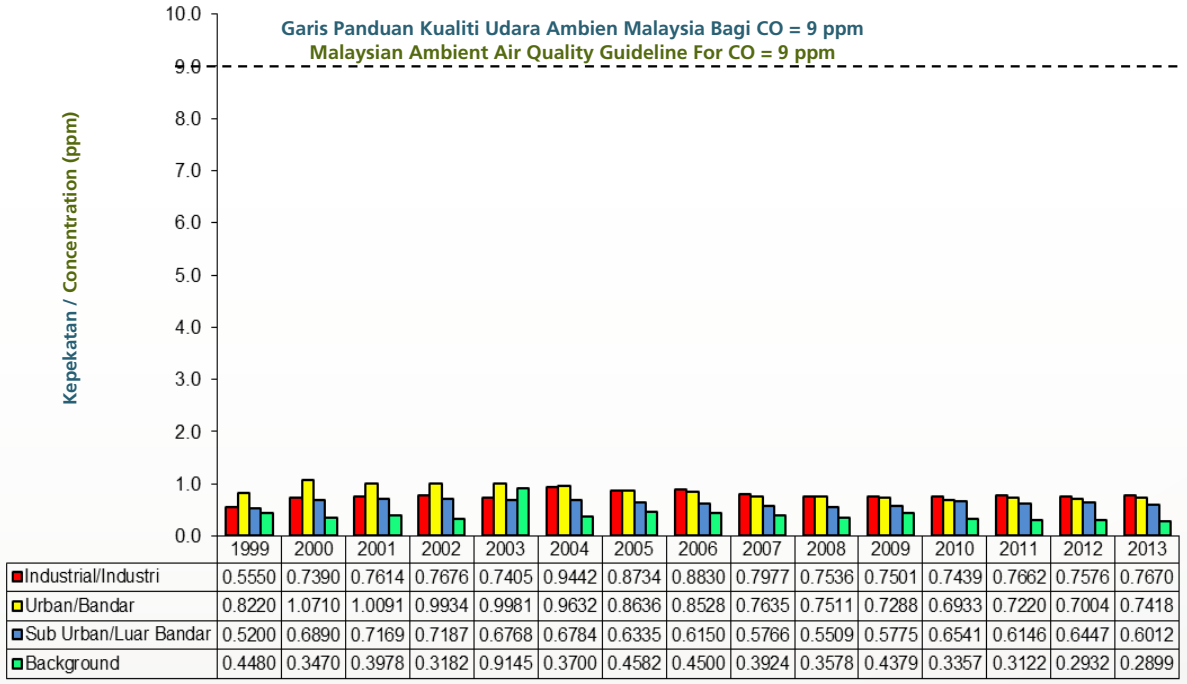
Carbon Monoxide (CO)

There was a slight increase of 0.4% CO level in 2013, as compared to 2012. However the trend of CO concentration from 1999 to 2013 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% of CO emission load in 2013. **Figure 1.12(a)** shows CO concentrations for various categories of land use.



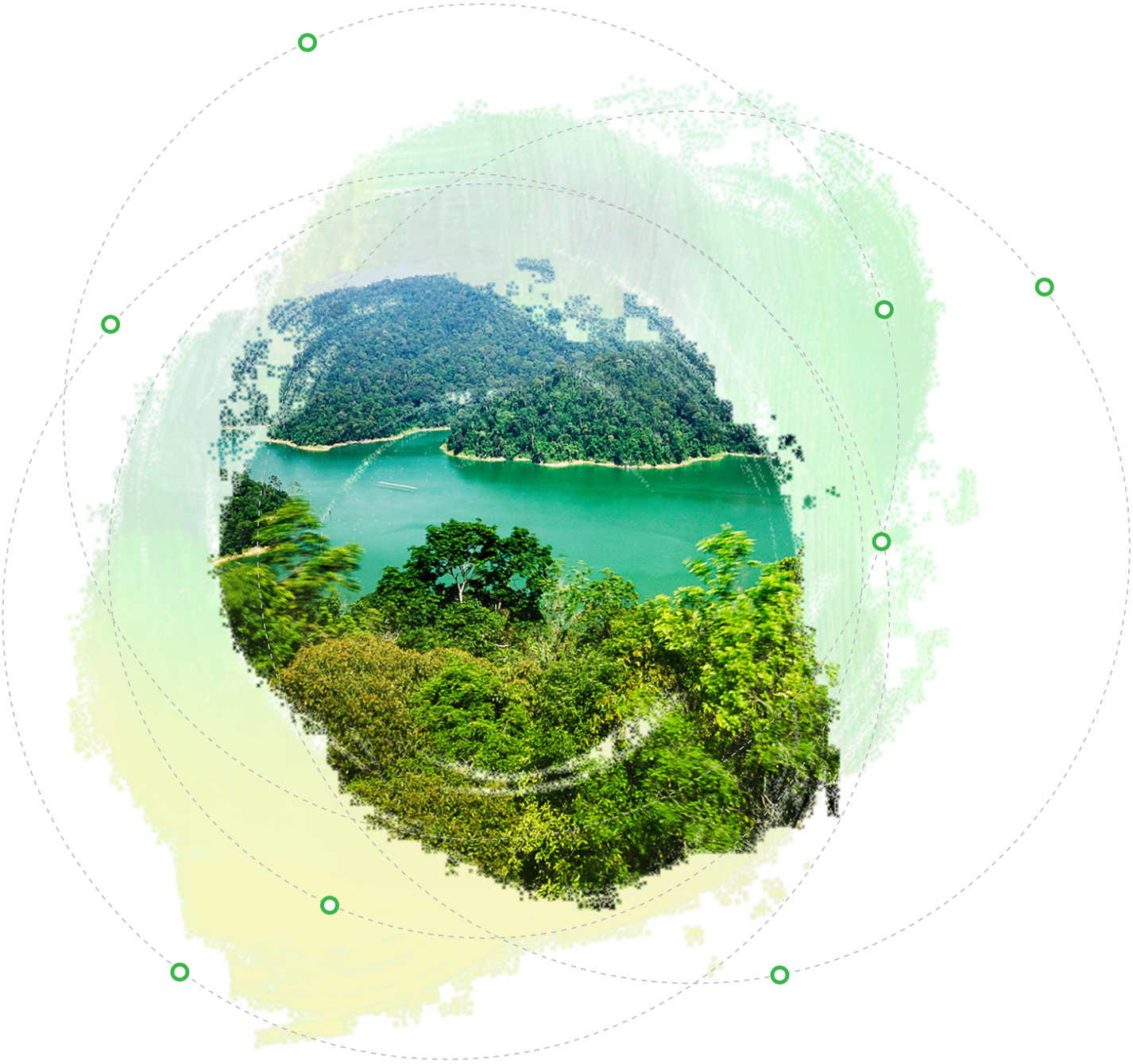
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Concentration/Kepekatan	0.5860	0.7120	0.7213	0.6995	0.8325	0.7389	0.7918	0.7649	0.6973	0.7309	0.6752	0.6510	0.6809	0.6827	0.6855
Number of Sites/ Bilangan Lokasi	35	39	39	39	41	41	41	41	41	41	41	41	41	41	41

Rajah 1.12 Malaysia: Purata Kepekatan Tahunan Karbon Monoksida (CO), 1999 - 2013
Figure 1.12 Malaysia: Annual Average Concentration of Carbon Monoxide (CO), 1999 - 2013



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Industrial/Industri	0.5550	0.7390	0.7614	0.7676	0.7405	0.9442	0.8734	0.8830	0.7977	0.7536	0.7501	0.7439	0.7662	0.7576	0.7670
Urban/Bandar	0.8220	1.0710	1.0091	0.9934	0.9981	0.9632	0.8636	0.8528	0.7635	0.7511	0.7288	0.6933	0.7220	0.7004	0.7418
Sub Urban/Luar Bandar	0.5200	0.6890	0.7169	0.7187	0.6768	0.6784	0.6335	0.6150	0.5766	0.5509	0.5775	0.6541	0.6146	0.6447	0.6012
Background	0.4480	0.3470	0.3978	0.3182	0.9145	0.3700	0.4582	0.4500	0.3924	0.3578	0.4379	0.3357	0.3122	0.2932	0.2899

Rajah 1.12(a) Malaysia: Purata Kepekatan Tahunan Karbon Monoksida (CO), 1999 - 2013
Figure 1.12(a) Malaysia: Annual Average Concentration of Carbon Monoxide (CO) by Land Use, 1999 - 2013



BAB 2
CHAPTER

PENGAWASAN BUNYI BISING AMBIEN

Pada tahun 2013, Jabatan Alam Sekitar (JAS) telah melaksanakan program pengawasan bunyi bising ambien di tiga (3) jenis penerimaan gunatanah yang berbeza iaitu kawasan sensitif bunyi bising, trafik dan industri seperti yang ditunjukkan dalam **Jadual 1.**

AMBIENT NOISE MONITORING

In 2013, the Department of Environment (DOE) conducted the ambient noise monitoring programme at three (3) different types of land use for noise sensitive areas, traffic and industry, as shown in **Table 1.**

Kategori / Categories	Lokasi / Location
Sensitif Bunyi Bising / Noise Sensitive	Sekolah / School
	Hospital / Hospital
	Tempat Keagamaan / Place of Worship
	Lapangan Terbang / Airport
Trafik / Traffic	Lebuhraya / Highway
	Jalan Persekutuan / Federal Road
	Jalan Luar Bandar / Suburban Road
Industri / Industry	Industri Berat / Heavy Industry
	Industri Sederhana / Medium Industry
	Industri Kecil / Small Industry

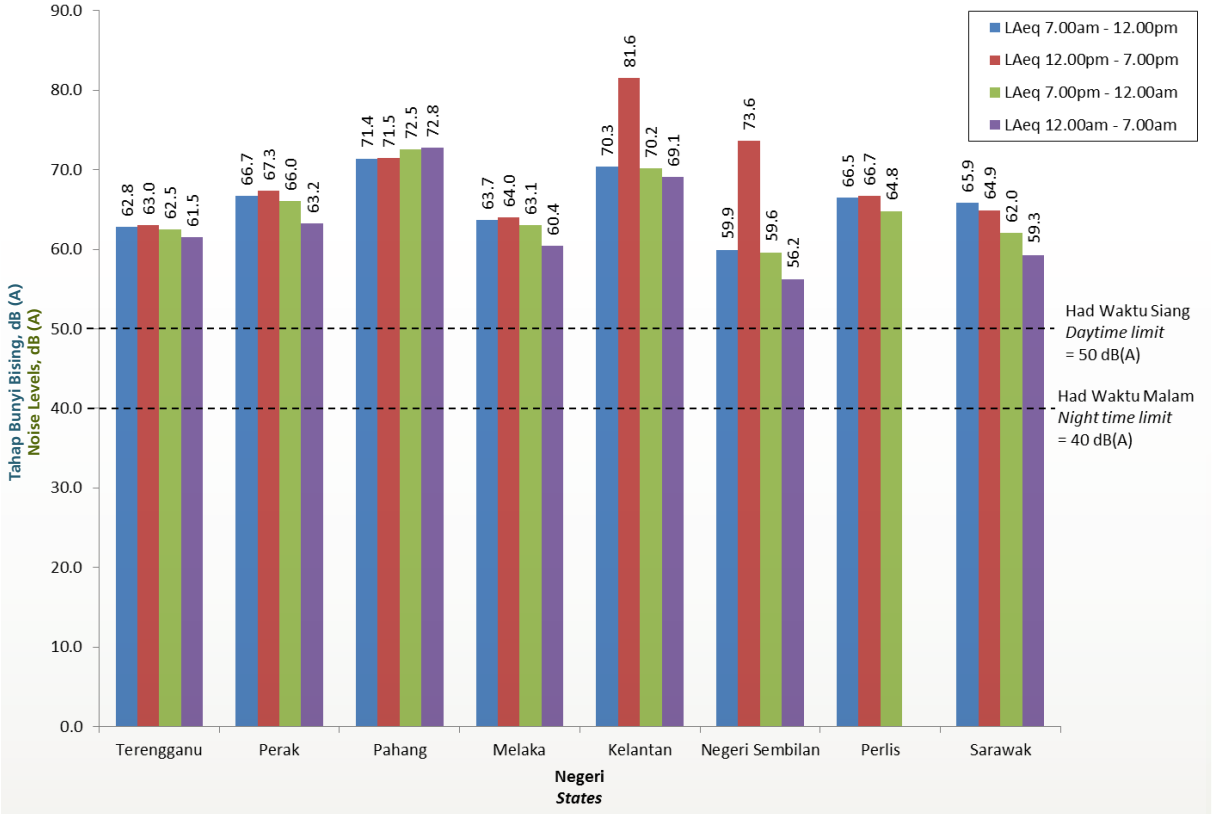
Jadual 1. Kategori guna tanah
Table 1. Categories of land use

Bagi tujuan pengawasan, 60 minit sampel bunyi bising diukur bagi empat (4) tempoh masa sepanjang hari. Pengukuran tersebut dilaksanakan oleh JAS Negeri. Data yang dikumpul daripada program ini akan memberi manfaat sebagai data asas untuk tujuan perancangan dan pembangunan peraturan bunyi bising pada masa hadapan. Data bunyi bising dicatatkan semasa program pengawasan dan perbandingan dibuat dengan menggunakan Garis Panduan Perancangan Untuk Had Dan Kawalan Bunyi Bising Persekitaran, 2004 yang diterbitkan oleh Jabatan Alam Sekitar.

Rajah 2.1 menunjukkan perbandingan tahap bunyi bising di kawasan sensitif seperti sekolah, masjid, lapangan terbang dan hospital. Pada tahun 2013, semua pengawasan di kawasan ini melebihi had waktu siang iaitu 50 dB(A) dan had waktu malam iaitu 40 dB(A) kerana pembangunan pesat di sekitar kawasan itu. Bacaan tertinggi iaitu 81.6 dB(A) dicatatkan di Kelantan antara 12:00pm hingga 7:00pm dan bacaan terendah iaitu 56.2 dB(A) telah dicatatkan di Negeri Sembilan antara 12:00am hingga 7:00am.

For monitoring purposes, a 60 minutes sample on noise levels were measured for four (4) periods during the day. The DOE state offices carried out these measurements. The valuable data collected from this exercise would be used as a baseline for future planning and also to develope on noise regulations. The Planning Guidelines for Environmental Noise Limits and Control, 2004, published by the Department of Environment was used as a comparison for all noise data recorded during this monitoring programme.

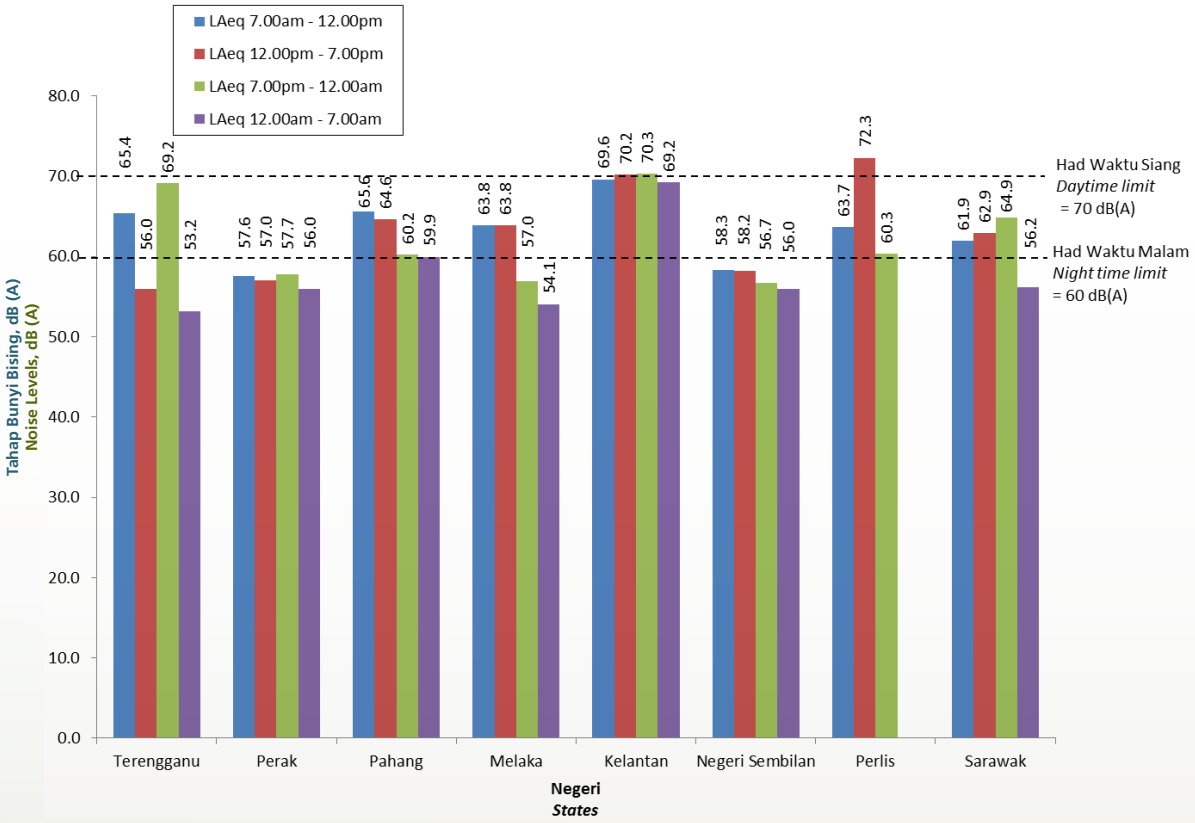
Figure 2.1 shows a comparison of noise levels in sensitive areas such as schools, mosques, airports and hospitals. Due to rapid development around the area, data from the monitoring exceeded the daytime limit of 50 dB(A) and the night time limit of 40 dB(A). Kelantan recorded the highest reading of 81.6 dB(A), between 12.00pm to 7.00pm, whilst the lowest reading of 56.2 dB(A) was recorded in Negeri Sembilan between 12am to 7am.



Rajah 2.1: Perbandingan Tahap Bunyi Bising di Kawasan Sensitif Mengikut Negeri
Figure 2.1: Comparison of Noise Levels for Noise Sensitif Areas in Various States

Rajah 2.2 menunjukkan perbandingan tahap bunyi bising di pelbagai kawasan industri. Kawasan ini dibahagikan kepada tiga (3) lokasi seperti industri berat, industri sederhana dan industri kecil. Ia menunjukkan bacaan tertinggi dicatatkan di Perlis dengan bacaan 72.3 dB(A) di antara 12:00pm hingga 7:00pm dan bacaan terendah yang dicatatkan adalah di Terengganu dengan bacaan 53.2 dB(A) di antara 12:00am hingga 7:00am.

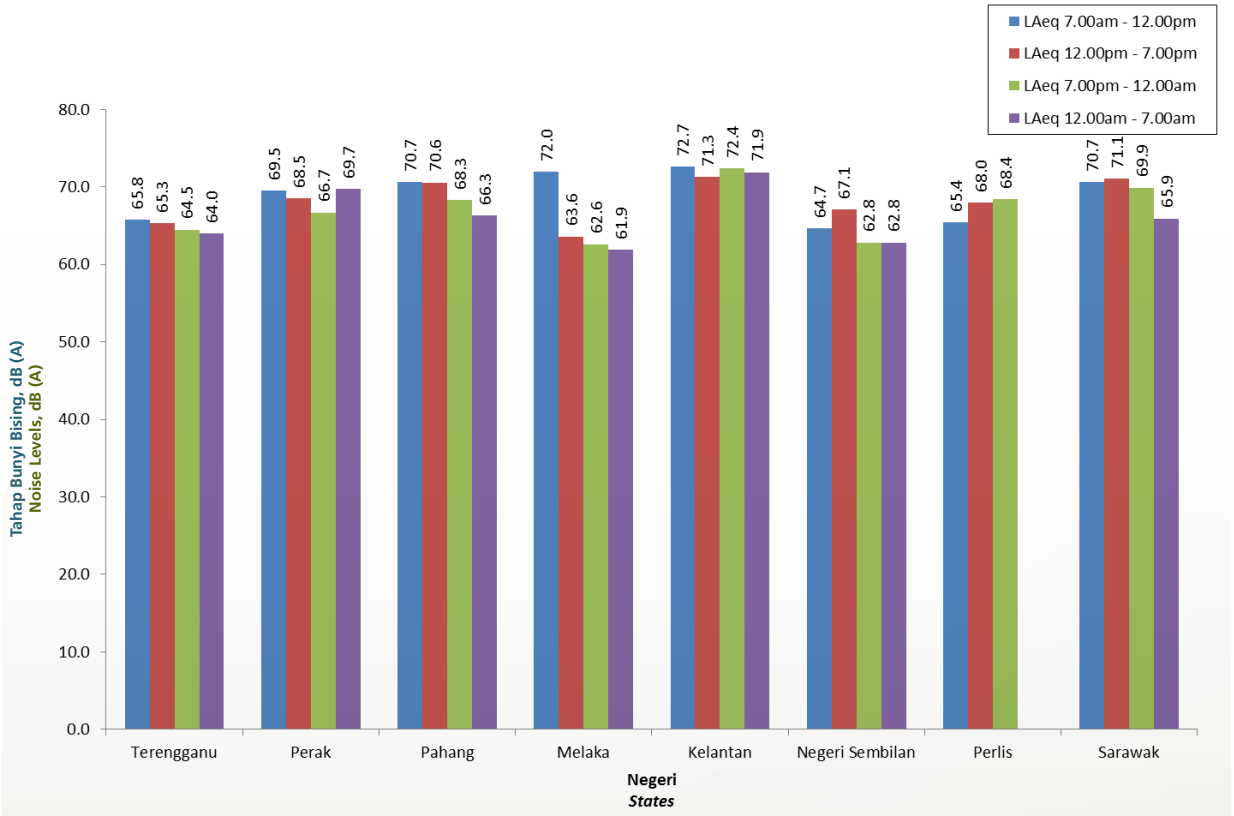
Figure 2.2 shows noise level comparisons within various industrial areas. These areas were divided into three main (3) locations, comprising of heavy industry, medium industry and small industry. Perlis recorded the highest reading with 72.3 dB(A), between 12.00pm to 7.00pm, whilst the lowest reading recorded between 12am to 7am was in Terengganu, at 53.2 dB(A).



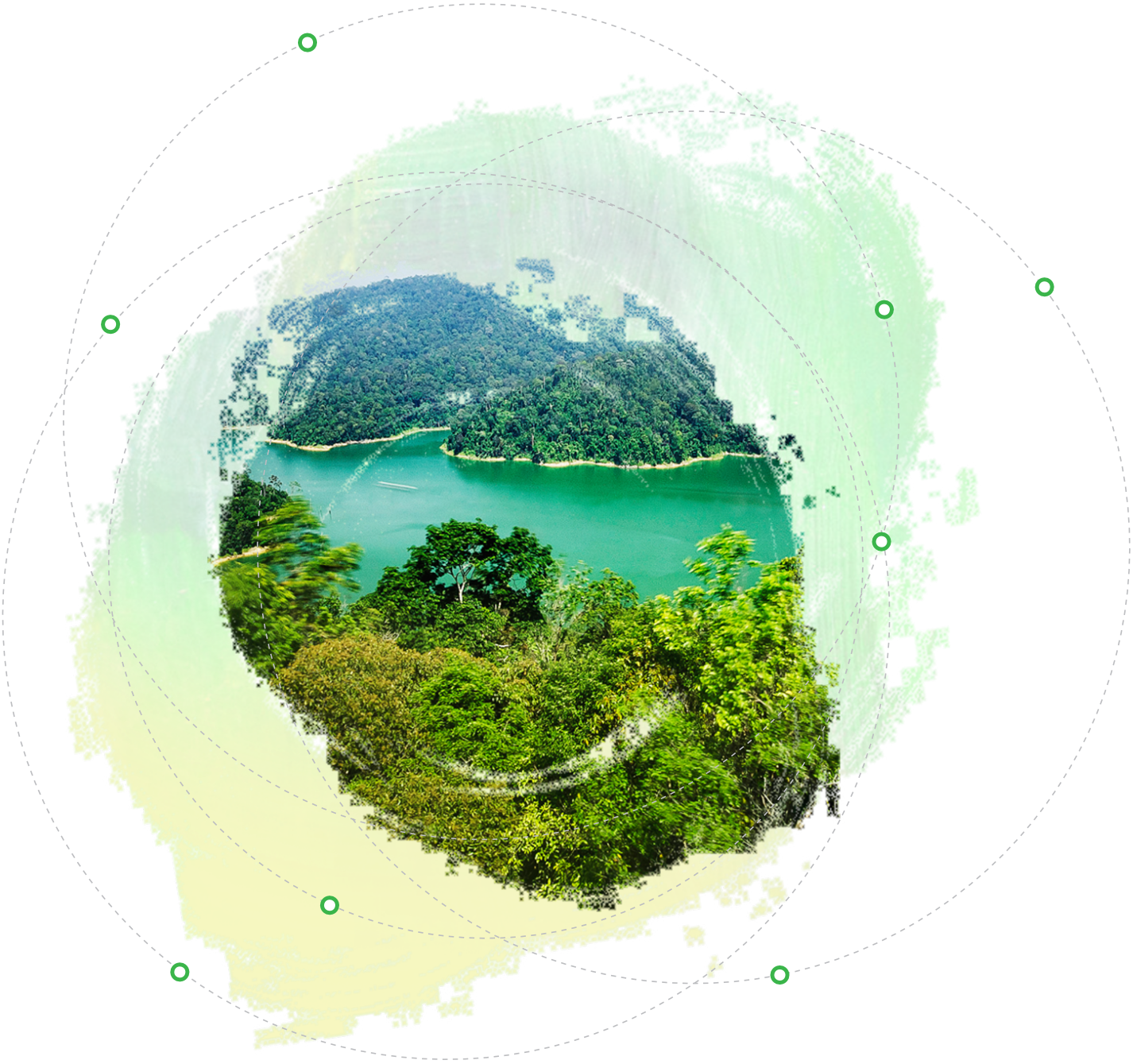
Rajah 2.2: Perbandingan Tahap Bunyi Bising di kawasan Industri Mengikut Negeri
Figure 2.2: Comparison of Noise Levels for Industrial Areas in Various States

Rajah 2.3 menunjukkan perbandingan tahap bunyi bising di pelbagai kawasan trafik seperti lebuh raya, jalan persekutuan dan jalan luar bandar. Tahap bunyi bising di lokasi-lokasi ini adalah di antara 63.6 dB(A) hingga 72.7 dB(A) bagi pemantauan pada waktu siang manakala pemantauan pada waktu malam mencatatkan bacaan antara 61.9 dB(A) hingga 72.4 dB(A). Ia menunjukkan bahawa bacaan pengawasan pada waktu siang mencatatkan bacaan yang lebih tinggi berbanding pengawasan pada waktu malam. Ini mungkin disebabkan bilangan kenderaan bermotor yang berkurangan di jalan raya pada waktu malam.

Figure 2.3 shows noise level comparisons within traffic areas such as highways, federal roads and suburban roads. Noise levels in these locations ranged between 63.6 dB(A) to 72.7 dB(A) during day time monitoring, while night time monitoring recorded readings between 61.9 dB(A) to 72.4 dB(A). Daytime monitoring recorded higher reading levels due to a probable decrease in number of motor vehicles on the road during night time.



Rajah 2.3: Perbandingan Tahap Bunyi Bising bagi Kawasan Trafik Mengikut Negeri
Figure 2.3: Comparison of Noise Levels for Traffic Areas in Various States



BAB 3
CHAPTER

KUALITI AIR SUNGAI
RIVER WATER QUALITY

PENGAWASAN KUALITI AIR SUNGAI

Jabatan Alam Sekitar (JAS) meneruskan program pengawasan kualiti air sungai pada tahun 2013 bagi menentukan kualiti air sungai dan mengesan perubahan ke atas kualiti air sungai. Sampel-sampel air sungai diambil daripada stesen-stesen yang telah ditetapkan dan diukur kualitinya secara in-situ serta dihantar ke makmal untuk dianalisis bagi menentukan kriteria dari segi fizik-kimia dan biologi. Indeks Kualiti Air (IKA) digunakan untuk mengukur tahap pencemaran dan kesesuaian jenis guna air seperti yang digariskan oleh Standard Kualiti Air Negara, Malaysia (National Water Quality Standards for Malaysia) (ANNEX). IKA telah mengambilkira parameter Oksigen Terlarut, Keperluan Oksigen Biokimia, Keperluan Oksigen Kimia, Ammonia Nitrogen, Pepejal Terampai dan pH.

RIVER WATER QUALITY MONITORING

In 2013, the Department of Environment (DOE) continued with the river water quality-monitoring programme, to determine the quality of river water and to detect any changes in quality of the river. Water samples were collected at regular intervals from designated stations, for in-situ and laboratory analysis, in determining its physio-chemical and biological characteristics. The Water Quality Index (WQI) was used to indicate the level of pollution and the suitability in terms of water 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 (NH_3-N), Suspended Solids (SS) and pH.

Pada tahun 2013, kualiti air sungai telah dinilai berdasarkan 6,057 sampel air sungai yang telah diambil daripada 891 stesen pengawasan manual yang merangkumi 477 sungai. Stesen-stesen tersebut adalah terdiri daripada 801 stesen ambien dan baseline, 55 stesen baru di hulu muka sauk terpilih, dan 35 stesen bagi projek River Of Life (ROL). Kualiti air sungai turut dinilai berdasarkan data daripada 10 stesen pengawasan automatik.

STATUS KUALITI AIR SUNGAI

Sebanyak 275 (58.1%) sungai daripada 473 sungai yang diawasi telah menunjukkan kualiti air bersih, 173 sungai (36.6%) adalah sederhana tercemar dan 25 (5.3%) adalah tercemar **(Rajah 3.1).** Status kualiti air sungai-sungai yang diawasi adalah seperti dalam **Jadual 3.1, 3.2 dan 3.3.**

Keperluan Oksigen Biokimia (BOD), Ammonia Nitrogen (NH_3-N) dan Pepejal Terampai (SS) masih menjadi punca kepada pencemaran sungai. BOD yang tinggi kerap kali dikaitkan dengan pengolahan sisa kumbahan yang tidak mencukupi, atau akibat pelepasan effluen daripada industri-industri pengilangan dan berasaskan pertanian. Punca utama NH_3-N pula boleh dikaitkan dengan aktiviti penternakan dan kumbahan domestik manakala punca utama SS adalah kerja-kerja tanah yang tidak teratur dan aktiviti pembukaan tanah.

This year, the quality of river water was also assessed based on a total of 6,057 samples, taken from 891 manual monitoring stations, covering 477 rivers. The stations comprised of 801 ambient and baseline stations, 55 new stations located upstream of selected water intakes, and 35 stations from the River of Life (ROL) project. Water quality was also assessed from 10 continuous water quality monitoring stations.

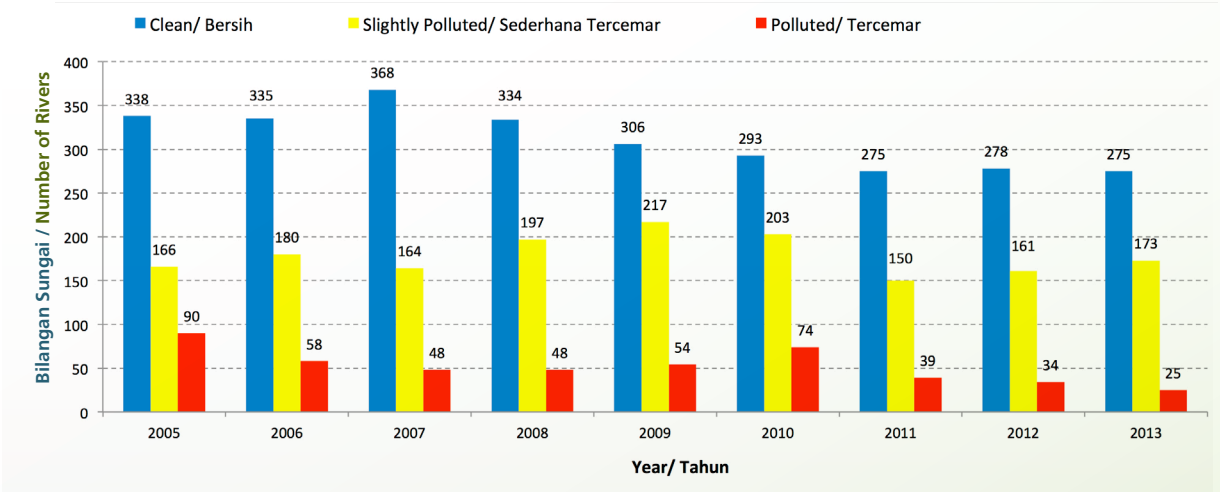
RIVER WATER QUALITY STATUS

Out of the 473 rivers monitored, 275 (58.1%) were asserted to be clean, 173 (36.6%) were slightly polluted and another 25 (5.3%) were found to be polluted **(Figure 3.1).** The rivers monitored and its overall quality status are shown in **Tables 3.1, 3.2 and 3.3.**

As in previous years, major pollutants detected were the Biochemical Oxygen Demand (BOD), Ammoniacal Nitrogen (NH_3-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 NH_3-N were found to be from livestock farming and domestic sewage, while the sources for SS were mainly due to improper earthworks and land clearing activities.

Jadual 3.4 menunjukkan sebanyak 11 daripada 25 sungai tercemar masih tergolong dalam Kelas III manakala 14 sungai adalam Kelas IV. Berdasarkan BOD, sebanyak lima (5) sungai diklasifikasikan sebagai Kelas IV manakala 20 adalah Kelas V. Dari segi NH_3-N pula, satu sungai masing-masing tergolong dalam Kelas I dan Kelas II, 12 sungai Kelas IV dan 11 adalah Kelas V. Dari segi SS, sebanyak enam (6) sungai telah diklasifikasikan sebagai Kelas I, 16 sungai Kelas II, dan 13 adalah Kelas III.

Table 3.4 shows that out of the 25 polluted rivers, 11 rivers were classified as Class III and 14 rivers as Class IV. In relations to BOD, five rivers were classified as Class IV and 20 rivers as Class V. For the pollutant NH_3-N, one (1) river was classified as Class I and Class II respectively, 12 rivers were classified as Class IV and 11 rivers as Class V. SS recordings for six (6) rivers were classified as Class I, 16 rivers as Class II, and three (3) rivers as Class III.



Rajah 3.1 Malaysia: Tren Kualiti Air Sungai, 2005-2013

Figure 3.1 Malaysia : River Water Quality Trend, 2005 - 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
JOHOR	BATU PAHAT	SG. AMRAN	1	77	82	II	B / C
		SG. BANTANG	1	93	91	II	B / C
		SG. MEREK	1	87	85	II	B / C
	BENUT	SG. PARIT HJ. YASSIN	1	83	85	II	B / C
	ENDAU	SG. ENDAU	3	86	86	II	B / C
		SG. JASIN	1	92	94	I	B / C
		SG. KAHANG	1	88	86	II	B / C
		SG. MAMAI	1	82	88	II	B / C
		SG. PALOH	1	88	83	II	B / C
		SG. SELAI	1	90	92	II	B / C
		SG. TAMOK	1	89	86	II	B / C
	JOHOR	SG. BELITONG	1	86	82	II	B / C
		SG. BKT. BESAR	1	88	85	II	B / C
		SG. JOHOR	4	82	81	II	B / C
		SG. LAYANG	1	92	85	II	B / C
		SG. LAYAU KIRI	1	86	85	II	B / C
		SG. LINGGIU	1	84	83	II	B / C
		SG. PANTI	1	90	85	II	B / C
		SG. PAPAN	1	83	81	II	B / C
		SG. PELEPAH	2	89	90	II	B / C
		SG. PENGGELI	2	85	83	II	B / C
		SG. REMIS	1	82	83	II	B / C
		SG. SAYONG	4	82	82	II	B / C
		SG. SELUYUT	1	86	82	II	B / C
		SG. SEMANGAR	1	86	84	II	B / C
		SG. TELOR	1	87	85	II	B / C
	PALOI	SG. PALOI	1	87	86	II	B / C
	SEDILI BESAR	SG. AMBAT	1	84	81	II	B / C
		SG. DOHOL	1	87	90	II	B / C
		SG. PASIR PANJANG	1	81	88	II	B / C
	BATU PAHAT	SG. TEMUBOR KANAN	1	80	83	II	B / C
JOHOR/N. SEMBILAN	MUAR	SG. AIR PANAS	1	94	91	II	B / C
		SG. JUASSEH	1	92	90	II	B / C
		SG. LABIS	1	83	88	II	B / C
		SG. SEGAMAT	1	85	85	II	B / C
KEDAH	KEDAH	SG. JANING	1	93	93	I	B / C
		SG. PDG TERAP	3	78	81	II	B / C

Jadual 3.1 Malaysia: Status Kualiti Air bagi Sungai Bersih, 2013

Table 3.1 Malaysia: Water Quality Status of Clean Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
		SG. PEDU	1	88	87	II	B / C
		SG. TEKAI	1	79	87	II	B / C
	KISAP	SG. KISAP	1	91	94	I	B / C
	MELAKA	SG. MELAKA KEDAH	1	84	84	II	B / C
		SG. PETANG	1	94	92	II	B / C
	MERBOK	SG. TOK PAWANG	1	88	87	II	B / C
		SG. TUPAH	1	88	90	II	B / C
KEDAH/P. PINANG	MUDA	SG. CHEPIR	1	86	89	II	B / C
		SG. KARANGAN KEDAH	1	87	84	II	B / C
		SG. KETIL	2	86	89	II	B / C
		SG. MUDA	4	89	87	II	B / C
		SG. PEGANG	1	91	94	I	B / C
		SG. SEDIM	1	84	83	II	B / C
KELANTAN	GOLOK	SG. GOLOK	5	87	89	II	B / C
		SG. LANAS	1	89	90	II	B / C
	KELANTAN	SG. BELATOP	2	77	84	II	B / C
		SG. BER	1	91	89	II	B / C
		SG. BEROK	3	86	84	II	B / C
		SG. BETIS	1	92	89	II	B / C
		SG. GALAS	5	88	88	II	B / C
		SG. KELANTAN	3	85	85	II	B / C
		SG. KERILLA	1	92	92	II	B / C
		SG. LEBIR	3	87	87	II	B / C
		SG. NAL	2	91	88	II	B / C
		SG. NENGGIRI	3	86	86	II	B / C
		SG. PERGAU	6	92	92	II	B / C
		SG. RELAI	1	87	89	II	B / C
		SG. SOKOR	1	86	86	II	B / C
		SG. TUANG	1	95	92	II	B / C
	KEMASIN	SG. SEMERAK	2	87	84	II	B / C
	PENGKALAN CHEPA	SG. RAJA GALI	1	80	83	II	B / C
MELAKA	DUYONG	SG. GAPAM	1	91	88	II	B / C
	KESANG	SG. CHOHONG	2	87	91	II	B / C
	MELAKA	SG. BTG.MELAKA	2	87	83	II	B / C
		SG. DUSUN	1	90	89	II	B / C
		SG. KEMUNTING	1	89	83	II	B / C
		SG. TAMPIN	1	92	93	I	B / C

Jadual 3.1 Malaysia: Status Kualiti Air bagi Sungai Bersih, 2013

Table 3.1 Malaysia: Water Quality Status of Clean Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
N.SEMBILAN	LINGGI	SG. BATANG PENAR	1	94	92	II	B / C
		SG. PEDAS	1	89	87	II	B / C
		SG. REMBAU	2	84	82	II	B / C
P.PINANG	JAWI	SG. JUNJONG	1	90	90	II	B / C
	KLUANG	SG. ARA PP	2	86	88	II	B / C
	PERAI	SG. KULIM	2	85	85	II	B / C
	PINANG	SG. AIR TERJUN	1	92	92	II	B / C
P.PINANG/ PERAK	KERIAN	SG. KECHIL	1	90	91	II	B / C
PAHANG	ANAK ENDAU	SG. ANAK ENDAU	2	86	82	II	B / C
	BEBAR	SG. MERBA	1	81	82	II	B / C
		SG. SERAI	2	71	82	II	B / C
	BERTAM	SG. BERTAM	1	69	86	II	B / C
		SG. BURUNG	1	87	91	II	B / C
		SG. HABU	1	91	92	II	B / C
		SG. LENGGOK	1	90	87	II	B / C
		SG. RINGLET	1	90	90	II	B / C
		SG. TELOM	2	80	84	II	B / C
		SG. TERLA	1	86	89	II	B / C
		SG. TRINGKAP	1	80	90	II	B / C
	CHERATING	SG. CHERATING	1	76	81	II	B / C
	KUANTAN	SG. KENAU	1	88	85	II	B / C
		SG. KUANTAN	5	86	83	II	B / C
		SG. PANDAN	1	88	88	II	B / C
		SG. TALAM	1	77	81	II	B / C
	MERCHONG	SG. MERCHONG	1	91	87	II	B / C
	PAHANG	SG. BENTONG	1	91	87	II	B / C
		SG. BENUS	2	93	91	II	B / C
		SG. BERKAPOR	1	89	87	II	B / C
		SG. JELAI	2	84	89	II	B / C
		SG. JEMPOL	2	85	88	II	B / C
		SG. KELAU	1	89	90	II	B / C
		SG. KERTAM	1	85	89	II	B / C
		SG. KOYAN	1	88	91	II	B / C
		SG. LEPAR	3	86	88	II	B / C
		SG. LIPIS	3	88	92	II	B / C
		SG. LUIT	1	86	87	II	B / C
		SG. MARAN	1	88	90	II	B / C
		SG. PAHANG	8	84	86	II	B / C

Jadual 3.1 Malaysia: Status Kualiti Air bagi Sungai Bersih, 2013

Table 3.1 Malaysia: Water Quality Status of Clean Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
		SG. PERTING	1	91	92	II	B / C
		SG. SEMANTAN	3	85	85	II	B / C
		SG. T. PAYA BUNGOR	1	86	87	II	B / C
		SG. TAHAN	1	89	92	II	B / C
		SG. TANGLIR	1	89	89	II	B / C
		SG. TASIK CHINI	1	85	86	II	B / C
		SG. TEKAL	1	81	83	II	B / C
		SG. TEKAM	2	85	82	II	B / C
		SG. TELANG	1	85	89	II	B / C
		SG. TEMBELING	1	87	91	II	B / C
		SG. TERANUM	1	95	91	II	B / C
		SG. TERAS	1	94	89	II	B / C
		SG. TERIS	3	82	88	II	B / C
		SG. TRIANG	2	85	86	II	B / C
	ROMPIN	SG. AUR	1	87	86	II	B / C
		SG. KERATONG	2	85	86	II	B / C
		SG. PONTIAN	1	89	84	II	B / C
		SG. PUKIN	1	92	87	II	B / C
		SG. ROMPIN	4	85	82	II	B / C
PERAK	BRUAS	SG. BRUAS	3	82	84	II	B / C
		SG. DANDANG	1	85	87	II	B / C
		SG. ROTAN	1	89	91	II	B / C
	KURAU	SG. ARA PERAK	2	93	92	II	B / C
		SG. KURAU	4	78	82	II	B / C
	PERAK	SG. BATANG PADANG	3	88	86	II	B / C
		SG. BIDOR	3	87	82	II	B / C
		SG. CHENDERIANG	1	85	86	II	B / C
		SG. CHEPOR	1	96	91	II	B / C
		SG. KAMPAR	2	89	90	II	B / C
		SG. KANGSAR	1	86	86	II	B / C
		SG. KERDAH	1	83	81	II	B / C
		SG. KINJANG	1	91	92	II	B / C
		SG. KINTA	6	81	82	II	B / C
		SG. KLAH	1	89	85	II	B / C
		SG. KUANG	1	88	87	II	B / C
		SG. PELUS	2	90	84	II	B / C
		SG. PERAK	8	88	88	II	B / C
		SG. RAIA	2	87	88	II	B / C
		SG. SUNGKAI	2	88	91	II	B / C

Jadual 3.1 Malaysia: Status Kualiti Air bagi Sungai Bersih, 2013

Table 3.1 Malaysia: Water Quality Status of Clean Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
	RAJA HITAM	SG. MANJONG	2	76	85	II	B / C
		SG. NYIOR	1	90	94	I	B / C
	SEPETANG	SG. BATU TEGOH	3	86	88	II	B / C
		SG. JANA	1	93	90	II	B / C
		SG. LIMAU	1	88	92	II	B / C
		SG. TEMERLOH	2	89	89	II	B / C
		SG. TRONG	1	91	93	I	B / C
PERAK / SELANGOR	BERNAM	SG. BERNAM	4	87	89	II	B / C
		SG. INKI	1	90	93	I	B / C
		SG. SLIM	2	86	88	II	B / C
		SG. TROLAK	1	90	92	II	B / C
PERLIS	PERLIS	SG. JARUM	1	83	82	II	B / C
		SG. JERNIH	1	87	86	II	B / C
		SG. NGULANG	1	77	83	II	B / C
		SG. PELARIT	1	93	91	II	B / C
		SG. WANG KELIAN	1	94	91	II	B / C
SABAH	APAS	SG. APAS	1	85	86	II	B / C
	BALUNG	SG. BALUNG	1	91	88	II	B / C
	BENGKOKA	SG. BENGKOKA	2	86	88	II	B / C
	BINGKONGAN	SG. BANDAU	1	92	88	II	B / C
		SG. BINGKONGAN	2	90	90	II	B / C
		SG. MENGGARIS	2	90	90	II	B / C
		SG. TANDEK	1	89	84	II	B / C
	BONGAWAN	SG. BONGAWAN	1	87	86	II	B / C
	BRANTIAN	SG. BRANTIAN	1	92	87	II	B / C
	KALABAKAN	SG. KALABAKAN	3	88	86	II	B / C
	KALUMPANG	SG. KALUMPANG	3	87	87	II	B / C
	KEDAMAIAN	SG. KEDAMAIAN	1	91	92	II	B / C
		SG. TEMPASUK	2	92	91	II	B / C
		SG. WARIU	1	91	92	II	B / C
	KIMANIS	SG. KIMANIS	1	87	86	II	B / C
	KINABATANGAN	SG. KARAMUAK	1	90	90	II	B / C
		SG. KINABATANGAN	3	88	86	II	B / C
		SG. KOYAH	1	89	87	II	B / C
		SG. MENANGGUL	1	89	84	II	B / C
	LABOK	SG. KINIPIR	2	92	93	I	B / C

Jadual 3.1 Malaysia: Status Kualiti Air bagi Sungai Bersih, 2013

Table 3.1 Malaysia: Water Quality Status of Clean Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
	LABOK	SG. LABOK	1	90	87	II	B / C
		SG. LIWAGU	2	93	91	II	B / C
		SG. MALIAU	1	93	92	II	B / C
		SG. TUNGUD	1	88	89	II	B / C
	LAKUTAN	SG. LAKUTAN	1	91	87	II	B / C
	LIKAS	SG. INANAM	3	84	85	II	B / C
		SG. MENGGATAL	2	86	89	II	B / C
	LINGKUNGAN	SG. BUKAU	1	89	84	II	B / C
		SG. LINGKUNGAN	1	92	85	II	B / C
	MEMBAKUT	SG. MEMBAKUT	1	85	84	II	B / C
	MENGGALONG	SG. MENGGALONG	2	90	87	II	B / C
	MEROTAI	SG. MEROTAI	3	89	82	II	B / C
	MOUNAD	SG. MOUNAD	2	91	88	II	B / C
	MOYOG	SG. MOYOG	4	90	91	II	B / C
	PADAS	SG. BUNSIT	1	93	91	II	B / C
		SG. LIAWAN	1	92	89	II	B / C
		SG. PADAS	3	85	84	II	B / C
		SG. PANGATAN	1	88	88	II	B / C
		SG. PEGALAN	3	90	89	II	B / C
		SG. TANDULU	1	92	89	II	B / C
	PAITAN	SG. PAITAN	1	84	85	II	B / C
	PAPAR	SG. PAPAR	3	89	88	II	B / C
	SAPI	SG. SUALONG	1	89	87	II	B / C
	SEGALIUD	SG. SEGALIUD	2	87	83	II	B / C
	SEGAMA	SG. SEGAMA	3	89	86	II	B / C
	SILABUKAN	SG. SILABUKAN	2	90	87	II	B / C
	SUGUT	SG. BONGKUD	1	94	91	II	B / C
		SG. LOHAN	1	94	90	II	B / C
		SG. MERALI	1	92	91	II	B / C
		SG. SUGUT	3	91	89	II	B / C
	TAWAU	SG. TAWAU	4	88	84	II	B / C
	TENGHILAN	SG. TENGHILAN	1	90	88	II	B / C
	TINGKAYU	SG. TINGKAYU	2	91	87	II	B / C
	TUARAN	SG. DAMIT	2	89	90	II	B / C
		SG. SONG SAI	1	90	88	II	B / C
		SG. TUARAN	2	93	89	II	B / C
	TUNGKU	SG. TUNGKU	2	88	89	II	B / C
	UMAS-UMAS	SG. UMAS-UMAS	1	91	87	II	B / C

Jadual 3.1 Malaysia: Status Kualiti Air bagi Sungai Bersih, 2013

Table 3.1 Malaysia: Water Quality Status of Clean Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
SARAWAK	BARAM	SG. TUTUH	1	82	82	II	B / C
	LAWAS	SG. LAWAS	3	90	87	II	B / C
	LIMBANG	SG. LIMBANG	5	88	84	II	B / C
	LUPAR	SG. AI	2	83	87	II	B / C
		SG. SEKERANG	1	87	83	II	B / C
		SG. UNDUP	1	78	84	II	B / C
	MIRI	SG. PADANG LIKU	1	86	85	II	B / C
	NIAH	SG. NIAH	2	80	82	II	B / C
		SG. SEKALOH	1	79	81	II	B / C
	RAJANG	SG. BINATANG	1	82	87	II	B / C
		SG. JULAU	1	83	82	II	B / C
		SG. SARIKEI	2	81	82	II	B / C
	SADONG	SG. SADONG	4	76	81	II	B / C
	SARAWAK	SG. SARAWAK KANAN	1	78	81	II	B / C
		SG. SARAWAK KIRI	1	81	84	II	B / C
		SG. SEMADANG	1	80	85	II	B / C
	SARIBAS	SG. LAYAR	2	72	83	II	B / C
	SIMILAJAU	SG. SIMILAJAU	2	84	83	II	B / C
	TRUSAN	SG. TRUSAN	1	90	85	II	B / C
SELANGOR	CHUAU	SG. CHUAU	2	87	82	II	B / C
	LANGAT	SG. JIJAN	1	84	84	II	B / C
		SG. LUI	1	90	94	I	B / C
		SG. SEMENYIH	1	88	90	II	B / C
	SELANGOR	SG. BATANG KALI	1	90	88	II	B / C
		SG. KANCHING	1	92	86	II	B / C
		SG. KERLING	1	93	91	II	B / C
		SG. SELANGOR	4	84	83	II	B / C
		SG. SERENDAH	1	90	87	II	B / C
	SEPANG	SG. SEPANG	2	71	84	II	B / C
	TENGI	SG. TENGI	3	76	81	II	B / C
TERENGGANU	BESUT	SG. BESUT	2	90	91	II	B / C
	CHUKAI	SG. BUNGKUS	1	76	81	II	B / C
		SG. IBOK	1	83	81	II	B / C
		SG. RUANG	1	76	81	II	B / C
	DUNGUN	SG. DUNGUN	4	91	90	II	B / C

Jadual 3.1 Malaysia: Status Kualiti Air bagi Sungai Bersih, 2013

Table 3.1 Malaysia: Water Quality Status of Clean Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
	KEMAMAN	SG. CHERUL	1	87	82	II	B / C
		SG. KEMAMAN	2	85	88	II	B / C
	KERTIH	SG. KERTIH	1	85	88	II	B / C
	MARANG	SG. MARANG	1	84	85	II	B / C
	PAKA	SG. PAKA	1	83	85	II	B / C
		SG. RASAU	1	82	86	II	B / C
	SETIU	SG. CHALOK	2	83	81	II	B / C
		SG. SETIU	2	88	89	II	B / C
	TERENGGANU	SG. BERANG	1	86	90	II	B / C
		SG. NERUS	1	82	84	II	B / C
		SG. PUEH	1	88	85	II	B / C
		SG. TELEMONG	1	87	89	II	B / C
		SG. TERENGGANU	3	84	85	II	B / C
WP.KL/ SELANGOR	KLANG	SG. PENCHALA	1	86	88	II	B / C
		SG. SEMELAH	1	85	83	II	B / C

Jadual 3.1 Malaysia: Status Kualiti Air bagi Sungai Bersih, 2013

Table 3.1 Malaysia: Water Quality Status of Clean Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
JOHOR	BATU PAHAT	SG. BATU PAHAT	1	68	63	III	ST / SP
		SG. BEKOK	5	82	78	II	ST / SP
		SG. BERLIAN	1	78	77	II	ST / SP
		SG. CHAAH	1	84	76	III	ST / SP
		SG. LENIK	1	84	79	II	ST / SP
		SG. MERPO	1	75	78	II	ST / SP
		SG. SEMBERONG	2	68	62	III	ST / SP
		SG. SIMPANG KANAN	2	66	60	III	ST / SP
		SG. SIMPANG KIRI	3	69	66	III	ST / SP
	BENUT	SG. BENUT	4	71	72	III	ST / SP
		SG. PINGGAN	1	61	63	III	ST / SP
		SG. ULU BENUT	1	67	71	III	ST / SP
	ENDAU	SG. JEBONG	1	72	68	III	ST / SP
		SG. LENGGOR	1	81	80	II	ST / SP
		SG. MELATAI	1	61	68	III	ST / SP
		SG. MENGKIBOL	3	74	74	III	ST / SP
		SG. PAMOL	1	73	62	III	ST / SP
		SG. SEMBERONG	5	81	77	II	ST / SP
		SG. SINGOL	1	76	72	III	ST / SP
	JEMALUANG	SG. JEMALUANG	2	85	79	II	ST / SP
	JOHOR	SG. ANAK SG. SAYONG	1	81	77	II	ST / SP
		SG. CHEMANGAR	1	86	71	III	ST / SP
		SG. LEBAM	1	73	70	III	ST / SP
		SG. SANTI	1	83	79	II	ST / SP
		SG. SEBOL	1	79	73	III	ST / SP
		SG. SEMENCHU	1	65	78	II	ST / SP
		SG. TEMOH	1	85	76	III	ST / SP
		SG. TIRAM	4	81	78	II	ST / SP
	KAW. PASIR GUDANG	SG. LATOH	1	54	61	III	ST / SP
	KIM-KIM	SG. KIM-KIM	2	64	65	III	ST / SP
	MERSING	SG. MERSING	2	85	80	II	ST / SP
	PONTIAN BESAR	SG. AIR HITAM JOHOR	1	69	67	III	ST / SP
		SG. PONTIAN BESAR	5	70	69	III	ST / SP

Jadual 3.2 Malaysia: Status Kualiti Air Sungai bagi Sungai Sederhana Tercemar, 2013

Table 3.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
	PONTIAN KECIL	SG. PONTIAN KECIL	2	75	74	III	ST / SP
	PULAI	SG. PULAI	2	82	76	III	ST / SP
		SG. ULU CHOH	1	66	64	III	ST / SP
	SANGLANG	SG. SANGLANG	1	52	60	III	ST / SP
	SEDILI BESAR	SG. SEDILI BESAR	5	79	78	II	ST / SP
	SEDILI KECIL	SG. ANAK SEDILI KECIL	1	76	75	III	ST / SP
		SG. BAHAN	2	79	77	II	ST / SP
		SG. SEDILI KECIL	2	79	80	II	ST / SP
	SKUDAI	SG. MELANA	2	66	67	III	ST / SP
		SG. SKUDAI	9	69	71	III	ST / SP
	TEBRAU	SG. BALA	1	57	61	III	ST / SP
		SG. PANDAN	1	59	63	III	ST / SP
		SG. PLENTONG	4	60	61	III	ST / SP
		SG. TEBRAU	4	66	64	III	ST / SP
JOHOR/N. SEMBILAN	MUAR	SG. GEMENCHEH	1	89	79	II	ST / SP
		SG. MEDA	1	82	79	II	ST / SP
		SG. MUAR	8	82	78	II	ST / SP
		SG. SARANG BUAYA	1	58	65	III	ST / SP
KEDAH	KEDAH	SG. KEDAH	1	63	65	III	ST / SP
		SG. PENDANG	1	76	78	II	ST / SP
	MERBOK	SG. BONGKOK	1	62	69	III	ST / SP
		SG. MERBOK	1	64	77	II	ST / SP
		SG. PETANI	1	58	68	III	ST / SP
KEDAH/P. PINANG	MUDA	SG. JERONG	1	72	67	III	ST / SP
KELANTAN	KEMASIN	SG. KEMASIN	2	81	73	III	ST / SP
	PENGKALAN CHEPA	SG. ALOR B	1	59	68	III	ST / SP
		SG. ALOR LINTAH	1	48	66	III	ST / SP
		SG. KELADI	1	83	78	II	ST / SP
		SG. PENGKALAN CHEPA	2	76	79	II	ST / SP
	PENGKALAN DATU	SG. PENGKALAN DATU	3	75	80	II	ST / SP
MELAKA	DUYONG	SG. DUYONG	3	76	72	III	ST / SP
	KESANG	SG. KESANG	3	71	78	II	ST / SP

Jadual 3.2 Malaysia: Status Kualiti Air Sungai bagi Sungai Sederhana Tercemar, 2013

Table 3.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
	MELAKA	SG. DURIAN TUNGGAL	1	82	74	III	ST / SP
		SG. MELAKA	5	76	75	III	ST / SP
		SG. REMBIA	1	61	64	III	ST / SP
N.SEMBILAN	LINGGI	SG. CHEMBONG	1	83	80	II	ST / SP
		SG. KEPAYONG	1	80	75	III	ST / SP
		SG. KUNDUR BESAR	1	74	75	III	ST / SP
		SG. LINGGI	5	74	75	III	ST / SP
		SG. SIMIN	1	69	74	III	ST / SP
		SG. SIPUT	1	82	78	II	ST / SP
P.PINANG	BAYAN LEPAS	SG. BAYAN LEPAS	1	67	73	III	ST / SP
		SG. TIRAM	2	74	72	III	ST / SP
	JAWI	SG. MACHANG BUBOK	1	79	74	III	ST / SP
	JURU	SG. KILANG UBI	4	69	71	III	ST / SP
		SG. PASIR	1	61	63	III	ST / SP
	KLUANG	SG. RELAU	1	74	76	III	ST / SP
	PERAI	SG. JARAK	3	72	73	III	ST / SP
		SG. KELADI KEDAH	1	79	79	II	ST / SP
		SG. PERAI	2	62	60	III	ST / SP
	PINANG	SG. AIR ITAM	5	59	67	III	ST / SP
		SG. DONDANG	1	61	67	III	ST / SP
		SG. PINANG	1	56	60	III	ST / SP
P.PINANG/ PERAK	KERIAN	SG. KERIAN	4	77	79	II	ST / SP
		SG. SELAMA	2	72	76	III	ST / SP
PAHANG	BALOK	SG. BALOK	2	69	69	III	ST / SP
		SG. PANJANG	1	77	75	III	ST / SP
	BEBAR	SG. BEBAR	1	61	64	III	ST / SP
	KUANTAN	SG. BELAT	1	79	79	II	ST / SP
		SG. CHARU	1	84	79	II	ST / SP
		SG. RIAU	1	82	75	III	ST / SP
	PAHANG	SG. BERA	2	78	80	II	ST / SP
		SG. CHINI	1	78	77	II	ST / SP
		SG. JENGKA	2	79	80	II	ST / SP
		SG. KUNDANG	1	76	76	III	ST / SP
		SG. MENTIGA	1	77	70	III	ST / SP

Jadual 3.2 Malaysia: Status Kualiti Air Sungai bagi Sungai Sederhana Tercemar, 2013

Table 3.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
		SG. SERTING	2	75	74	III	ST / SP
		SG. TASIK BERA	1	83	79	II	ST / SP
	TONGGOK	SG. TONGGOK	1	70	73	III	ST / SP
PERAK	PERAK	SG. KEPAYANG	2	75	63	III	ST / SP
		SG. NYAMOK	1	76	68	III	ST / SP
		SG. PARI	1	79	70	III	ST / SP
		SG. PINJI	2	68	68	III	ST / SP
		SG. SELUANG	1	62	61	III	ST / SP
		SG. SEROKAI	1	64	64	III	ST / SP
		SG. TUMBOH	1	64	66	III	ST / SP
	RAJA HITAM	SG. RAJA HITAM	2	57	69	III	ST / SP
	SEPETANG	SG. SEPETANG	2	76	76	III	ST / SP
	WANGI	SG. DERALIK	1	72	76	III	ST / SP
		SG. WANGI	1	77	78	II	ST / SP
PERLIS	PERLIS	SG. PERLIS	1	64	67	III	ST / SP
SABAH	LIKAS	SG. LIKAS	2	79	79	II	ST / SP
	SAPI	SG. SAPI	3	87	80	II	ST / SP
	SEMBULAN	SG. SEMBULAN	2	67	78	II	ST / SP
	TELIPOK	SG. TELIPOK	2	79	77	II	ST / SP
SARAWAK	BALINGIAN	SG. BALINGIAN	2	76	72	III	ST / SP
	BARAM	SG. BARAM	4	73	75	III	ST / SP
	KAYAN	SG. KAYAN	3	71	73	III	ST / SP
	KEMENA	SG. KEMENA	3	79	79	II	ST / SP
		SG. SIBIU	1	80	77	II	ST / SP
	KERIAN	SG. KERIAN	2	65	70	III	ST / SP
		SG. SEBLAK	1	65	76	III	ST / SP
	LUPAR	SG. LUPAR	3	72	74	III	ST / SP
		SG. SETERAP	1	72	75	III	ST / SP
	MIRI	SG. ADONG	1	63	62	III	ST / SP
		SG. LUTONG	1	72	67	III	ST / SP
		SG. MIRI	2	64	65	III	ST / SP
	MUKAH	SG. MUKAH	4	75	72	III	ST / SP
	OYA	SG. OYA	3	75	70	III	ST / SP
	RAJANG	SG. BALOI	1	84	78	II	ST / SP
		SG. KANOWIT	1	86	79	II	ST / SP
		SG. MERADONG	1	74	79	II	ST / SP
		SG. RAJANG	11	79	77	II	ST / SP
		SG. SALIM	1	79	72	III	ST / SP

Jadual 3.2 Malaysia: Status Kualiti Air Sungai bagi Sungai Sederhana Tercemar, 2013

Table 3.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
SARAWAK	SADONG	SG. KARANGAN	2	79	78	II	ST / SP
	SARAWAK	SG. KUAP	1	70	71	III	ST / SP
		SG. MAONG KIRI	1	69	63	III	ST / SP
		SG. SAMARAHAN	2	69	73	III	ST / SP
		SG. SARAWAK	6	77	80	II	ST / SP
		SG. SEMENGGOH	1	65	64	III	ST / SP
		SG. TABUAN	1	69	70	III	ST / SP
	SARIBAS	SG. SARIBAS	1	72	79	II	ST / SP
	SEMUNSAM	SG. SEMUNSAM	1	70	79	II	ST / SP
	SIBUTI	SG. KABULOH	2	71	69	III	ST / SP
		SG. KEJAPIL	2	85	80	II	ST / SP
		SG. SATAP	1	72	63	III	ST / SP
		SG. SIBUTI	2	79	75	III	ST / SP
	SUAI	SG. SUAI	1	76	79	II	ST / SP
	TATAU	SG. TATAU	1	86	78	II	ST / SP
SELANGOR	BULOH	SG. BULOH	4	56	60	III	ST / SP
	CHUAU	SG. ANAK CHUAU	1	75	70	III	ST / SP
	LANGAT	SG. BATANG NILAI	1	71	68	III	ST / SP
		SG. LANGAT	7	73	72	III	ST / SP
		SG. PAJAM	1	75	70	III	ST / SP
	SELANGOR	SG. SEMBAH	1	67	68	III	ST / SP
TERENGGANU	CHUKAI	SG. CHUKAI	1	77	80	II	ST / SP
	IBAI	SG. IBAI	3	78	75	III	ST / SP
	KEMAMAN	SG. RANSAN	1	50	73	III	ST / SP
	KLUANG	SG. KLUANG	1	80	73	III	ST / SP
	MERANG	SG. MERANG	1	82	64	III	ST / SP
	MERCHANG	SG. MERCHANG	1	65	70	III	ST / SP
WP.KL/ SELANGOR	KLANG	SG. AMPANG	2	74	66	III	ST / SP
		SG. ANAK AIR BATU	1	76	74	III	ST / SP
		SG. BATU	3	75	76	III	ST / SP
		SG. DAMANSARA	2	69	76	III	ST / SP
		SG. GOMBAK	3	78	73	III	ST / SP
		SG. JINJANG	1	65	60	III	ST / SP
		SG. KEROH	2	78	75	III	ST / SP
		SG. KLANG	8	64	65	III	ST / SP
		SG. RASAU	1	77	75	III	ST / SP

Jadual 3.2 Malaysia: Status Kualiti Air Sungai bagi Sungai Sederhana Tercemar, 2013

Table 3.2 Malaysia: Water Quality Status of Slightly Polluted Rivers, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	BILANGAN STESEN / NUMBER OF STATIONS	IKA / WQI		STATUS 2013	
				2012	2013	KELAS / CLASS	KATEGORI / CATEGORY
JOHOR	AIR BALOI	SG. AIR BALOI	3	50	49	IV	T / P
	DANGA	SG. DANGA	2	55	47	IV	T / P
	KAW. PASIR GUDANG	SG. BULUH	1	48	48	IV	T / P
		SG. MASAI	1	51	54	III	T / P
		SG. PEREMBI	1	56	58	III	T / P
		SG. TUKANG BATU	1	35	38	IV	T / P
	KEMPAS	SG. KEMPAS	2	55	49	IV	T / P
	PONTIAN BESAR	SG. AYER MERAH	1	29	32	IV	T / P
	RAMBAH	SG. RAMBAH	2	59	58	III	T / P
	SEGGET	SG. SEGGET	5	58	52	III	T / P
	TEBRAU	SG. SEBULUNG	1	44	48	IV	T / P
		SG. SENGKUANG	1	36	37	IV	T / P
		SG. TAMPOI	1	50	57	III	T / P
MELAKA	MERLIMAU	SG. MERLIMAU	2	52	45	IV	T / P
	SERI MELAKA	SG. SERI MELAKA	1	55	57	III	T / P
P.PINANG	JAWI	SG. JAWI	1	44	55	III	T / P
	JURU	SG. JURU	2	47	55	III	T / P
		SG. RAMBAI	1	53	57	III	T / P
	PERAI	SG. KEREH	2	50	52	III	T / P
		SG. PERTAMA	1	47	48	IV	T / P
	PINANG	SG. JELUTONG	1	36	35	IV	T / P
SARAWAK	MIRI	SG. DALAM	1	69	56	III	T / P
WP.KL/ SELANGOR	KLANG	SG. BUNOS	3	65	59	III	T / P
		SG. TOBA	1	61	59	III	T / P
		SG. UNTUT	1	63	48	IV	T / P

Jadual 3.3 Malaysia: Status Kualiti Air Sungai bagi Sungai Tercemar, 2013

Table 3.3 Malaysia: Water Quality Status of Polluted Rivers, 2013

STATE/ NEGERI	RIVER BASIN/ LEMBANGAN SUNGAI	RIVER/ SUNGAI	STATUS 2013		CLASS BASED ON:/ KELAS BERDASARKAN:		
			WQI/ IKA	CLASS/ KELAS	BOD	AN	SS
SELANGOR/ WPKL	KLANG	SG. BUNOS	59	III	V	IV	I
SELANGOR/ WPKL	KLANG	SG. TOBA	59	III	V	V	II
JOHOR	RAMBAH	SG. RAMBAH	58	III	V	II	II
JOHOR	KAW. PASIR GUDANG	SG. PEREMBI	58	III	IV	IV	II
MELAKA	SERI MELAKA	SG. SERI MELAKA	57	III	IV	IV	I
P.PINANG	JURU	SG. RAMBAI	57	III	IV	IV	II
SARAWAK	MIRI	SG. DALAM	57	III	V	V	II
JOHOR	TEBRAU	SG. TAMPOI	57	III	V	IV	II
P.PINANG	JAWI	SG. JAWI	55	III	IV	IV	III
P.PINANG	JURU	SG. JURU	55	III	V	IV	II
JOHOR	KAW. PASIR GUDANG	SG. MASAI	54	III	IV	IV	I
P.PINANG/KEDAH	PERAI	SG. KEREH	52	IV	V	V	II
JOHOR	SEGGET	SG. SEGGET	52	IV	V	V	II
JOHOR	AIR BALOI	SG. AIR BALOI	49	IV	V	I	III
JOHOR	KEMPAS	SG. KEMPAS	49	IV	V	V	II
P.PINANG	PERAI	SG. PERTAMA	48	IV	V	IV	III
JOHOR	TEBRAU	SG. SEBULUNG	48	IV	V	IV	I
SELANGOR/ WPKL	KLANG	SG. UNTUT	48	IV	V	V	I
JOHOR	KAW. PASIR GUDANG	SG. BULUH	48	IV	V	IV	II
JOHOR	DANGA	SG. DANGA	47	IV	V	V	II
MELAKA	MERLIMAU	SG. MERLIMAU	45	IV	V	V	II
JOHOR	KAW. PASIR GUDANG	SG. TUKANG BATU	38	IV	V	V	II
JOHOR	TEBRAU	SG. SENGKUANG	37	IV	V	V	II
P.PINANG	PINANG	SG. JELUTONG	35	IV	V	V	II
JOHOR	PONTIAN BESAR	SG. AYER MERAH	32	IV	V	IV	I

Jadual 3.4 Malaysia: Sungai Tercemar dan Kelas Kualiti Air Berdasarkan BOD, AN dan SS, 2013

Table 3.4 Malaysia: The Polluted Rivers and Classes Based on BOD, AN and SS, 2013

PENGAWASAN KUALITI AIR SUNGAI AUTOMATIK

Rajah 3.2 menunjukkan lokasi sepuluh stesen pengawasan sungai automatik serta takat pengambilan air yang disenaraikan seperti dalam **Jadual 3.5**.

Oksigen Terlarut adalah penunjuk kepada kehadiran BOD yang disebabkan oleh bahan pencemar organik. Berdasarkan Oksigen Terlarut, 95% daripada data yang direkodkan di stesen automatik di Sg. Perak adalah berada dalam julat Kelas IIB NWQS, diikuti oleh Sg. Rajang (62%), Sg. Selangor (35%), Sg. Linggi (27%), Sg. Labu (18%), Sg. Sarawak (13%), Sg. Melaka (12%), and Sg. Skudai (11%). Manakala hanya 2% daripada data yang direkodkan di stesen automatik di Sg. Jinjang dan 0.5% di Sg. Putat adalah berada dalam Kelas IIB **(Rajah 3.3).**

Ammonium adalah satu bentuk ammonia yang telah terion. Pengukuran ammonium boleh memberi petunjuk kepada potensi kehadiran pencemar ammonia atau ammonia nitrogen dalam air sungai apabila pH dan suhu air berubah. Sebanyak 63% daripada data ammonium yang direkodkan di Sg. Labu adalah dalam Kelas IIB bagi julat ammonia nitrogen diikuti dengan Sg. Selangor (59%), Sg. Melaka (50%), Sg. Sarawak (36%), Sg. Skudai (23%) dan Sg. Perak (10%). Manakala kurang daripada 5% data ammonium daripada Sg. Putat, Sg Jinjang and Sg. Rajang berada dalam Kelas IIB **(Rajah 3.4).**

CONTINUOUS RIVER WATER QUALITY MONITORING

Figure 3.2 shows the location of ten continuous river monitoring stations and its subsequent water intakes, as listed in **Table 3.5.**

Dissolved Oxygen (DO) is an indication of BOD strength exerted by organic pollutants. Based on dissolved oxygen level, 95% of the data recorded at Sg. Perak were within the Class IIB of the NWQS, followed by Sg. Rajang (62%), Sg. Selangor (35%), Sg. Linggi (27%), Sg. Labu (18%), Sg. Sarawak (13%), Sg. Melaka (12%), and Sg. Skudai (11%). Meanwhile, only 2% of the data recorded at Sg. Jinjang and 0.5 % of the data at Sg. Putat were within the Class IIB (**Figure 3.3).**

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 and temperature changes. About 63% of the ammonium levels recorded at Sg. Labu were within Class IIB limit for ammoniacal nitrogen, followed by Sg. Selangor (59%), Sg. Melaka (50%), Sg. Sarawak (36%), Sg. Skudai (23%) and Sg. Perak (10%). Meanwhile, less than 5% of ammonium from Sg. Putat, Sg. Jinjang and Sg. Rajang were within the Class IIB limits **(Figure 3.4).**

Kekeruhan digunakan sebagai penunjuk kehadiran pepejal terampai di dalam sungai. Sebanyak 82% daripada keseluruhan data kekeruhan yang dicatatkan di stesen automatik Sg. Sarawak adalah berada dalam julat Kelas IIB NWQS dikuti oleh Sg. Putat (80%), Sg. Perak (54%), Sg. Jinjang (49%), Sg. Labu (41%) dan Sg. Skudai (37%). Manakala kurang daripada 10% daripada data kekeruhan di Sg. Selangor, Sg Linggi dan Sg. Rajang berada dalam julat tersebut dan kesemua data kekeruhan yang direkodkan di stesen automatik di Sg. Melaka telah melebihi had 50 NTU bagi Kelas IIB **(Rajah 3.5).**

Turbidity is used as an indication of suspended solids for a river. From all data recorded, 82% of turbidity for Sg. Sarawak were within the Class IIB of the NWQS, followed by Sg. Putat (80%), Sg. Perak (54%), Sg. Jinjang (49%), Sg. Labu (41%), and Sg. Skudai (37%). Meanwhile, less than 10% of turbidity for Sg. Selangor, Sg Linggi and Sg. Rajang were within the stated limit, whereas all of the turbidity recorded from Sg. Melaka exceeded the 50 NTU Class IIB limit of the NWQS **(Figure 3.5).**

pH adalah ukuran bagi keasidan dan kealkalian mengikut skala pH. Lebih 99.9% data pH yang direkodkan di stesen automatik di Sg. Labu, Sg. Sarawak dan Sg. Putat adalah dalam julat Kelas II NWQS diikuti oleh Sg. Jinjang (99.7%), Sg. Perak (97.8%), Sg. Linggi (97.4%), Sg. Skudai (95.1%), Sg. Melaka (91.0%) dan Sg. Rajang (89.8%). Manakala, hanya 20% daripada data pH yang direkodkan di stesen aitomatik di Sg. Selangor berada dalam Kelas II. **(Rajah 3.6).**

pH is a measurement of acidity and alkalinity that is based on a pH scale. More than 99.9% of pH recorded at automatic stations in Sg. Labu, Sg. Sarawak and Sg. Putat were within Class IIB NWQS, followed by Sg. Jinjang (99.7%), Sg. Perak (97.8%), Sg. Linggi (97.4%), Sg. Skudai (95.1%), Sg. Melaka (91.0%) and Sg. Rajang (89.8%). Meanwhile, only 20% of pH from the automatic station at Sg. Selangor were within the limits of Class IIB **(Figure 3.6).**

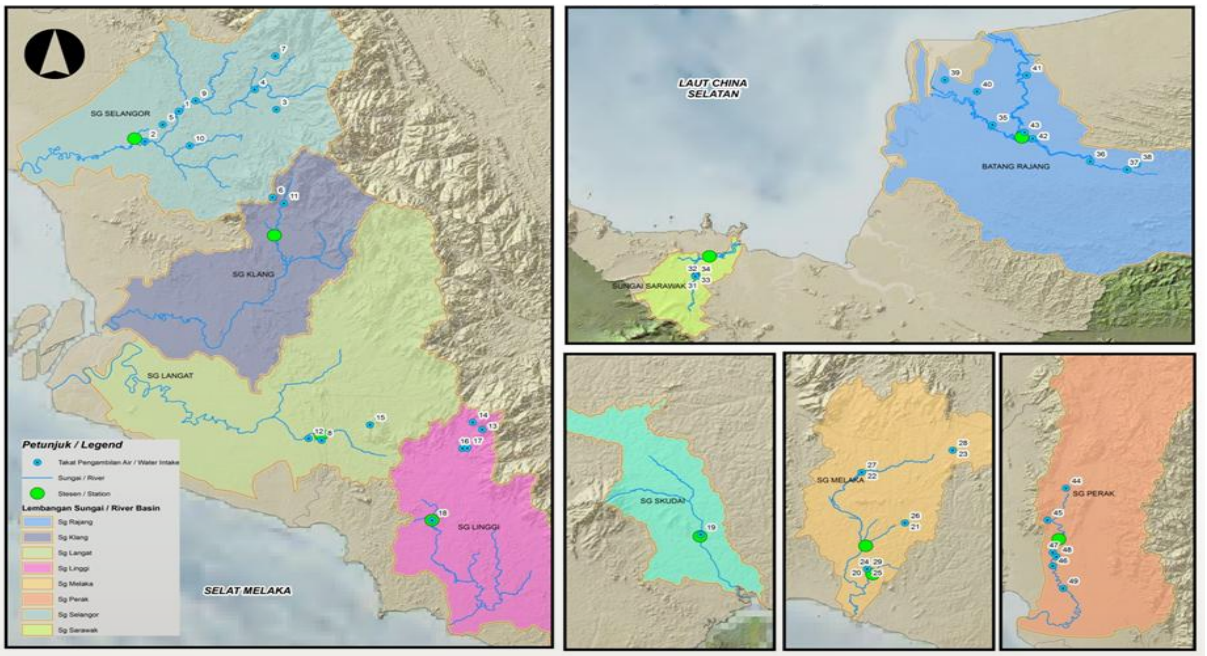


Figure 3.2 Continuous Water Quality Stations and Water Intakes

Rajah 3.2 Stesen Pengawasan Sungai Automatik dan Takat Pengambilan Air

Nombor / Number	Negeri / State	Sungai / River	Skim Perbekalan / Supply Scheme
1	Selangor	Sungai Selangor	SSP 2, Bukit Badong
2		Sungai Selangor	Rantau Panjang
3		Sungai Batang Kali	Batang Kali
4		Sungai Selangor	Rasa
5		Sungai Selangor	SSP 3, Bukit Badong
6		Sungai Rangkap	Sungai Rangkap
7		Sungai Kubu	Kuala Kubu Bharu
8		Sungai Labu	Sungai Labu
9		Sungai Tengi	Sungai Tengi
10		Sungai Darah	Sungai Buaya
11		Empangan Batu	Sungai Batu
12		Sungai Labu	Salak Tinggi
13	N. Sembilan	Sg Batang Penar	Pantai
14		Sg. Ngoi-Ngoi	Ngoi-ngoi
15		Sg Mahang	Mahang
16		Sg Batang Penar	Sungai Terip
17		Empangan Sg. Terip	Terip
18		Sg. Linggi	Sg. Linggi

Jadual 3.5 Senarai Takat Pengambilan Air dalam Kawasan Tadahan seperti Rajah 2.2

Table 3.5 Water Intake List within Catchments as in Figure 2.2

Nombor / Number	Negeri/ State	Sungai/ River	Skim Perbekalan / Supply Scheme
19	Johor	Sg. Skudai	Johor Bahru
20	Melaka	Sg. Melaka	Jasin, Melaka Tengah dan Alor Gajah
21		Empangan Durian Tunggal	Melaka Tengah, Alor Gajah dan Jasin
22		Sg. Melaka (Bunded Storage)	Melaka Tengah, Alor Gajah dan Jasin
23		Sg. Kesang	Jasin dan Merlimau
24		Sg. Muar	Melaka Tengah, Alor Gajah dan Jasin
25		Sg. Melaka	Jasin, Melaka Tengah dan Alor Gajah
26		Empangan Durian Tunggal	Melaka Tengah, Alor Gajah dan Jasin
27		Sg. Melaka (Bunded Storage)	Melaka Tengah, Alor Gajah dan Jasin
28		Sg. Kesang	Jasin dan Merlimau
29		Sg. Muar	Melaka Tengah, Alor Gajah dan Jasin
30	Sarawak	Sg. Sarawak Kiri	Weir Batu Kitang
31		Sg. Sarawak Kiri	Sungai Sarawak (Sarawak Kiri- Intake-Takat Pengambilan No. 1)
32		Sg. Sarawak Kiri	Sungai Sarawak (Sarawak Kiri- Intake-Takat Pengambilan No. 2)
33		Sg. Sarawak Kiri	Sungai Sarawak (Sarawak Kiri- Intake-Takat Pengambilan No. 3)
34		Sg. Sarawak Kiri	Sungai Sarawak (Sarawak Kiri- Intake-Takat Pengambilan No. 4)
35		Sg.Bawang Assan	Bawang Assan
36		Sg.Kanowit	Kanowit
37		Batang Rajang	Ng.Dap
38		Sg.Kabah	Ng.Tada
39		Sg.Daro	Daro
40		Sg. Nanggar	Kut
41		Sg.Rasau	Rasau
42		Batang Rajang	Sibu
43		Batang Rajang	Sibu
44	Perak	Sg. Perak (dalam kawasan tadahan LPA Kg. Gajah)	Kota Lama Kiri
45		Sg. Guar	Manong
46		Sg. Perak (dalam kawasan tadahan LPA Kg. Gajah)	Teluk Kepayang
47		Sg. Perak (dalam kawasan tadahan LPA Kg. Gajah)	Kampung Paloh
48		Sg. Perak (dalam kawasan tadahan LPA Kg. Gajah)	BB Seri Iskandar
49		Sg. Perak	Kampung Gajah

Jadual 3.5 Senarai Takat Pengambilan Air dalam Kawasan Tadahan seperti Rajah 2.2

Table 3.5 Water Intake List within Catchments as in Figure 2.2

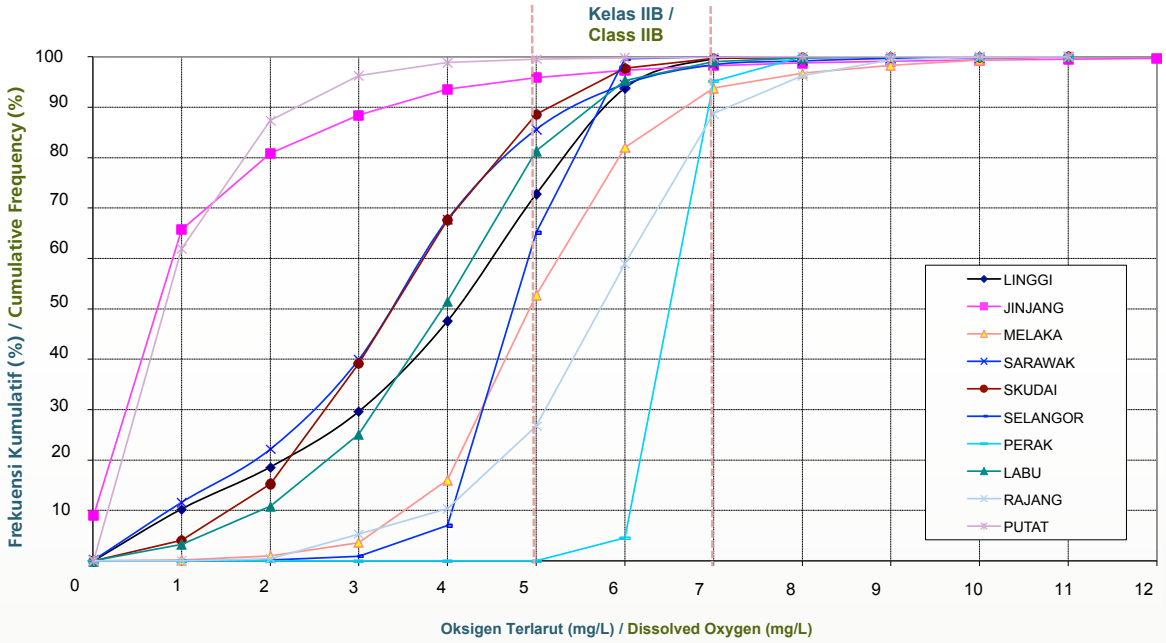
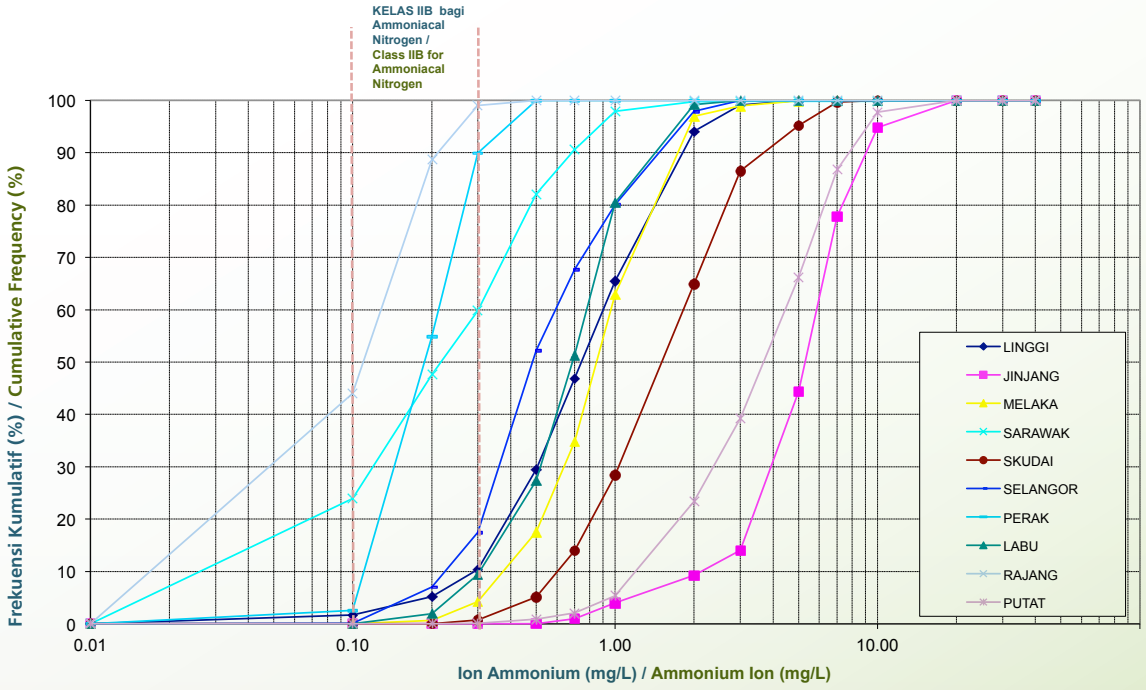


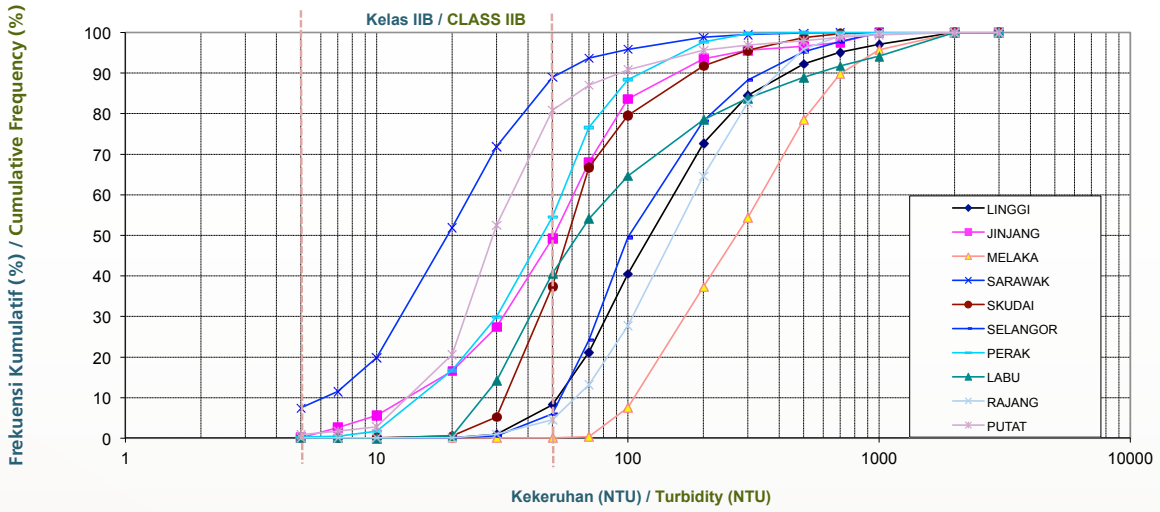
Figure 3.3 Comparison of Cumulative Frequency for 10 CWQM Stations for Dissolved Oxygen, 2013

Rajah 3.3 Perbandingan Frekuensi Kumulatif bagi 10 Stesen-stesen CWQM untuk Oksigen Terlarut, 2013



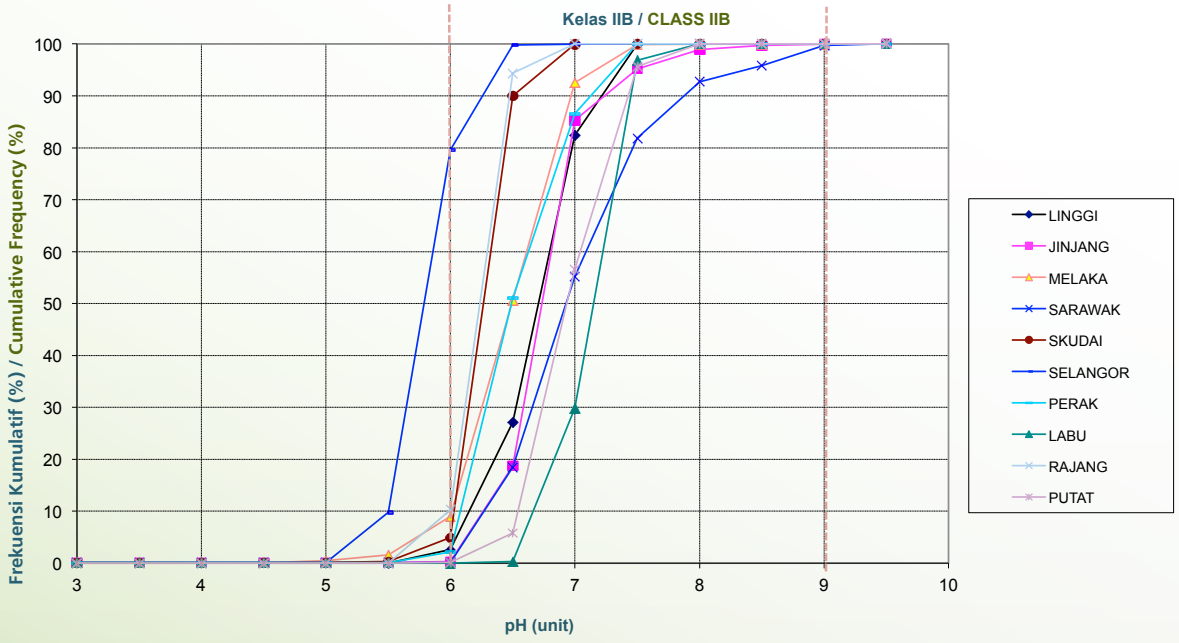
Rajah 3.4 Perbandingan Frekuensi Kumulatif bagi 10 Stesen-stesen CWQM untuk Ion Ammonium, 2013

Figure 3.4 Comparison of Cumulative Frequency for 10 CWQM Stations for Ammonium Ion Concentration, 2013



Rajah 3.5 Perbandingan Frekuensi Kumulatif bagi 10 Stesen-stesen CWQM untuk Kekeruhan, 2013

Figure 3.5 Comparison of Cumulative Frequency for 10 CWQM Stations for Turbidity, 2013



Rajah 3.6 Perbandingan Frekuensi Kumulatif bagi 10 Stesen-stesen CWQM untuk pH, 2013

Figure 3.6 Comparison of Cumulative Frequency for 10 CWQM Stations for pH, 2013

TREN PENCEMARAN AIR SUNGAI

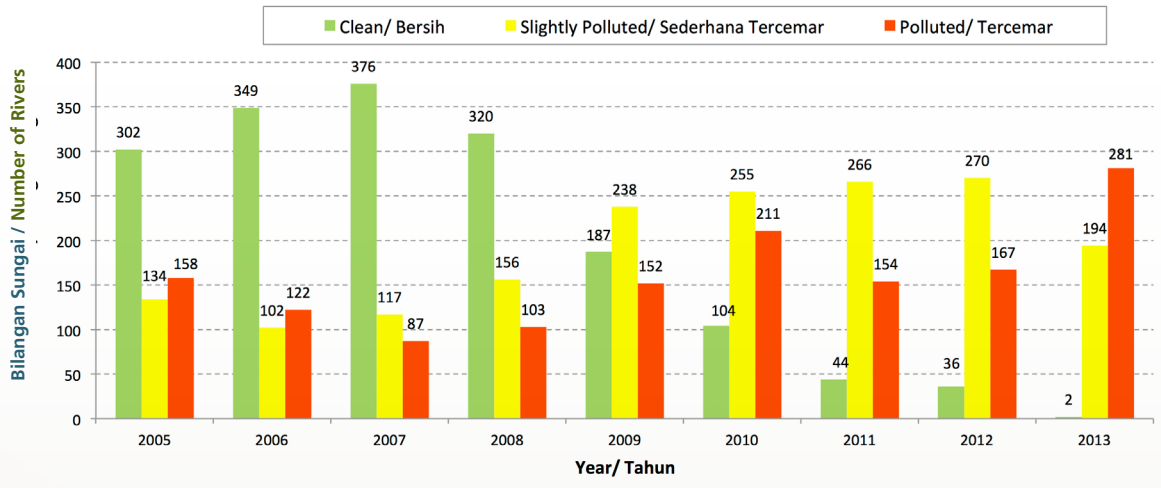
Kualiti air sungai yang ditentukan dari segi IKA telah menunjukkan sedikit kemerosotan pada tahun 2013. Peratus bilangan sungai yang dikategorikan sebagai bersih telah menurun kepada 58% pada tahun 2013 berbanding tahun sebelumnya (59%). Walau bagaimanapun, peratus bilangan sungai yang dikategorikan sebagai tercemar telah berkurang daripada 7% kepada 5% tahun lepas. Tren ini ditunjukkan di **Rajah 3.1.**

Berdasarkan sub-indeks BOD, bilangan sungai yang dikategorikan sebagai bersih telah menurun daripada 36 pada tahun 2012 kepada 2 sungai sahaja pada tahun 2013 **(Rajah 3.7).** Kemerosotan kualiti air yang disebabkan oleh BOD adalah berpunca daripada pelbagi punca pencemaran bahan organik seperti industri, serta aktiviti komersil dan domestik. Walau bagaimanapun, bilangan sungai bersih dari segi sub-indeks NH_3-N telah meningkat daripada 147 (2012) kepada 178 (2013) **(Rajah 3.8)**. Bilangan sungai yang dikategorikan bersih dari segi sub-indeks SS pula turut meningkat daripada 338 (2012 kepada 353 pada tahun 2013 **(Figure 3.9)**. Peningkatan kualiti air sungai ini mungkin disebabkan oleh penambahbaikan kemudahan pengolahan kumbahan dan kawalan berterusan ke atas aktiviti kerja tanah dan pembukaan tanah.

TREND IN RIVER WATER POLLUTION

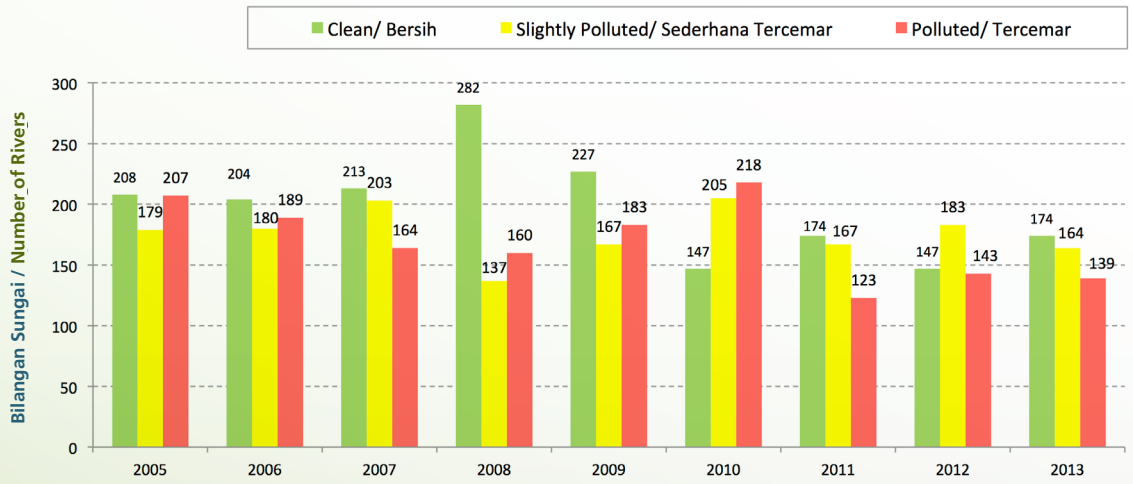
River water quality, based on WQI, had shown a slight decrease in 2013. The percentage of clean rivers had dropped to 58% the same year, as compared to the previous year (59%). The percentage of polluted rivers, however, had decreased from 7%, in the previous year, down to 5% in 2013. These trends are shown in **Figure 3.1.**

Based on BOD sub-indexes, the number of clean rivers had significantly decreased from 36 in 2012 two 2 rivers in 2013 **(Figure 3.7).** The degradation of river water quality caused by BOD may have been attributed to various sources of organic pollutants, including industrial, domestic and commercials activities. Based on NH_3-N sub-indexes, the number of clean rivers had increase from 147 in 2012, to 178 rivers in 2013 **(Figure 3.8).** Similarly, the number of clean rivers had increased from 338 (2012) to 353 in 2013 **(Figure 3.9)**, based on SS sub-indexes. These improvements in river water quality can be credited to advances in sewage treatment facilities, as well as constant control against improper earthworks and land clearing activities.



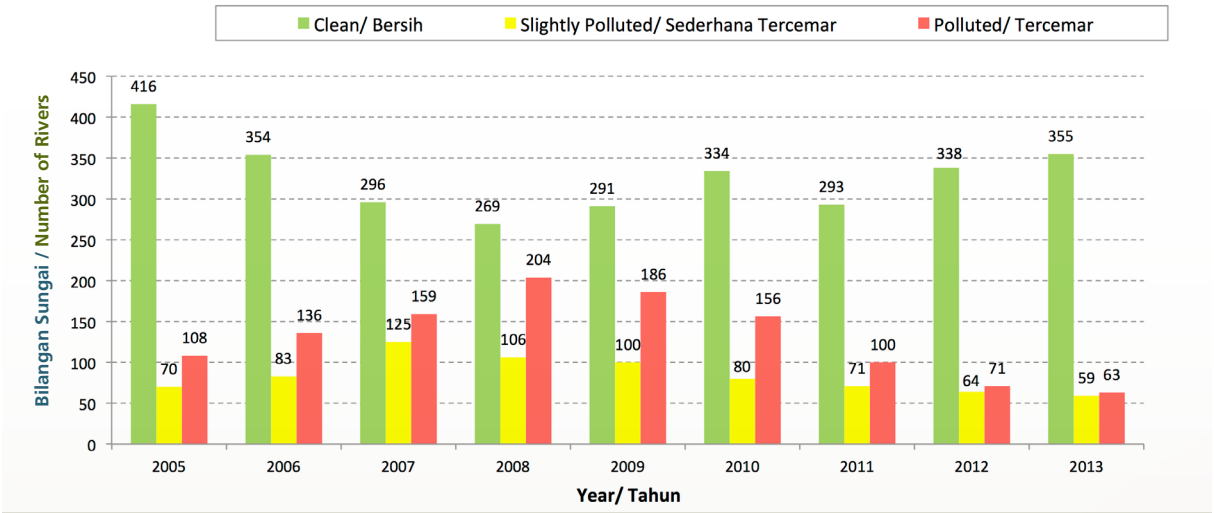
Rajah 3.7 Malaysia: Tren Kualiti Air Sungai Berdasarkan Sub-Indeks BOD, 2005-2013

Figure 3.7 Malaysia : River Water Quality Trend Based on BOD Sub-Index , 2005 - 2013



Rajah 3.8 Malaysia: Tren Kualiti Air Sungai Berdasarkan Sub-Indeks AN, 2005 - 2013

Figure 3.8 Malaysia:River Water Quality Trend Based on AN Sub-Index , 2005 - 2013



Rajah 3.9 Malaysia: Tren Kualiti Air Sungai Berdasarkan Sub-Indeks SS, 2005 - 2013

Figure 3.9 Malaysia: River Water Quality Trend Based on SS Sub-Index, 2005 - 2013

LOGAM BERAT DALAM SUNGAI

Analisis kandungan beberapa jenis logam berat dalam air sungai telah dilakukan ke atas Raksa (Hg), Arsenik (As), Kadmium (Cd), Kromium (Cr), Plumbum (Pb), dan Zink (Zn). Kesemua data Pb dan Cd yang direkodkan adalah berada dalam julat Kelas IIB NWQS. Manakala 99.93% data Zn berada dalam Kelas IIB dikuti oleh 99.86% bagi Cr, 99.61% bagi Hg dan 98.15 % bagi data As.

KUALITI AIR SUNGAI DI HULU MUKA SAUK

Pada tahun 2013, sebanyak 41 (75%) stesen pengawasan kualiti air di hulu muka sauk telah menunjukkan kualiti air bersih sementara 14 (25%) stesen dikategorikan sebagai sederhana tercemar. Berdasarkan IKA, lima (5) (9%) stesen telah dikategorikan

HEAVY METALS IN RIVERS

Rivers were analysed for heavy metals such as Mercury (Hg), Arsenic (As), Cadmium (Cd), Chromium (Cr), Plumbum (Pb), and Zinc (Zn). All Pb and Cd data recorded were within the Class IIB limits of the NWQS. Meanwhile, 99.93% of Zn data were within Class IIB limits, followed by 99.86% of Cr, 99.61% of Hg and 98.15 % for As.

RIVER QUALITY FOR UPSTREAM WATER INTAKES

In 2013, 41 (75%) monitoring stations from upstream water intakes had recorded clean water quality, while 14 (25%) other stations were categorized as slightly polluted. Based on the overall WQI, five(5) (9%) stations were categorized as Class I, 41 (75%) were

sebagai kelas I dan 41 (75%) adalah Kelas II manakala sembilan (9) (16%) adalah Kelas III. **Jadual 3.6** menunjukkan status kualiti air di stesen hulu muka sauk terpilih.

Dari segi BOD, empat (4) stesen menunjukkan kualiti air Kelas II, 28 Kelas III, 19 dan empat (4) adalah masing-masing Kelas IV dan Kelas V. Berdasarkan NH_3-N pula, sebanyak 39 stesen menunjukkan kualiti air Kelas I, 14 stesen Kelas II dan satu (1) bagi Kelas III dan Kelas IV. Sementara dari segi SS, 33 stesen telah dikategorikan sebagai Kelas I, 12 stesen Kelas II dan 10 stesen Kelas III.

Rajah 3.10 menunjukkan peratusan stesen hulu muka sauk berdasarkan kelas kualiti air dan parameter utama. **Jadual 3.7**, **Jadual 3.8** dan **Jadual 3.9** menunjukkan kualiti air sungai di stesen di hulu muka sauk masing-masing berdasarkan sub-indeks BOD, AN dan SS.

Class II, while nine (9) (16%) were categorized as Class III. **Table 3.6** shows water quality levels of water intake stations.

Based on BOD, four(4) stations showed a water quality of Class II, 28 a Class III, 19 and 4 stations a Class IV and Class V respectively. In term of NH_3 N, 39 stations showed a Class I water quality, 14 stations a Class II, while one (1) indicated a Class III and Class IV, collectively. Meanwhile, based on SS, 33 stations were categorized as Class I, 12 as Class II and 10 as Class III.

Figure 3.10 shows the percentage of water quality from upstream intake stations based on classes and main parameters. **Table 3.7, Table 3.8 and Table 3.9** shows water quality from stations upstream of water intake points, based on BOD, AN and SS sub-indexes.

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					IKA / WQI	KATEGORI / CATEGORY	KELAS/ CLASS
PERLIS	PERLIS	SG. TERUSAN MADA	2PS13	Loji Rawatan Air Arau Fasa IV	86	B / C	II
			2PS14	Loji Rawatan Air TTPC, Sg. Baru	85	B / C	II
KEDAH	KEDAH	SG. AHNING	2KD11	Padang Sanai	90	B / C	II
		SG. PDG TERAP	2KD12	Kuala Nerang	89	B / C	II
		SG. TEMIN	2KD10	Changloon	75	ST / SP	III
KEDAH (LANGKAWI)	MELAKA	SG. MELAKA	2LG05	Ulu Melaka	90	B / C	II
		SG. SAGA	2LG06	Padang Saga	91	B / C	II
KEDAH/ P.PINANG	MUDA	SG. MUDA	2MD16	Jeneri	86	B / C	II
			2MD17	Jeniang	87	B / C	II
			2MD18	Bukit Selambau	89	B / C	II
			2MD20	Pinang Tunggal	85	B / C	II
		SG. NAMI	2MD21	Nami	85	B / C	II
		SG. SEDIM	2MD19	Bikan	88	B / C	II
P.PINANG	PINANG	SG. SATU	2PG12	Batu Feringgi	96	B / C	I
PERAK	KURAU	SG. AIR HITAM	2KU07	Loji Rawatan Air Jelai	93	B / C	I
	PERAK	SG. MANONG	2PK62	Loji Rawatan Air Manong	89	B / C	II
		SG. SAUK	2PK61	Loji Rawatan Air Sauk	96	B / C	I
		SG. TESONG	2PK64	Loji Rawatan Air Sg. Klah	94	B / C	I
		SG. WOH	2PK63	Loji Rawatan Air Kuala Woh	89	B / C	II
	SEPETANG	SG. BATU TEGOH	2SP18	Loji Rawatan Air Bukit Larut	88	B / C	II
SELANGOR/ PERAK	BERNAM	SG. GELINTING	1BM15	Loji Rawatan Air Ulu Slim	92	B / C	II
		SG. TROLAK	1BM14	Loji Rawatan Air Trolak Timur	92	B / C	II
SELANGOR/ PUTRAJAYA/ N.SEMBILAN	LANGAT	SG. BATANG LABU	1L26	Loji Rawatan Air Salak Tinggi	70	ST / SP	III
		SG. SEMENYIH	1L09	Loji Rawatan Air Semenyih	76	ST / SP	III
SELANGOR / WPKL	KLANG	SG. GOMBAK	1K53	Loji Rawatan Air Gombak	95	B / C	I

Jadual 3.6 Malaysia: Status Kualiti Air di Hulu Muka Sauk, 2013

Table 3.6 Malaysia: Water Quality Status of Upstream Water Intakes, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					IKA / WQI	KATEGORI / CATEGORY	KELAS/ CLASS
MELAKA	KESANG	SG. CHIN-CHIN	1KA08	Muka sauk Loji Rawatan Air Chin-chin	72	ST / SP	III
JOHOR	BATU PAHAT	SG. SEMBERONG DAM	3BP27	Semberong Dam	73	ST / SP	III
	BENUT	SG. MACHAP DAM	3BN10	Machap Dam	79	ST / SP	II
	PULAI	SG. PULAI DAM	3PU04	Pulai Dam	90	B / C	II
JOHOR / N. SEMBILAN/ PAHANG	MUAR	SG. JELAI	1MN23	Loji Rawatan Air Dangi	78	ST / SP	II
		SG. JEMENTAH	3MR39	Loji Rawatan Air Jementah	92	B / C	II
		SG. MUAR	3MR38	Loji Rawatan Air Gombang	74	ST / SP	III
PAHANG	BERTAM	SG. BERTAM	2CH15	Loji Rawatan Air Habu	90	B / C	II
		SG. TERLA	2CH14	Loji Rawatan Air Kuala Terla	89	B / C	II
		SG. ULONG	2CH16	Brinchang Dam	92	B / C	II
PAHANG / JOHOR	ENDAU	SG. KAHANG	3ED38	Jalan Felda Kahang Timur, Kluang	83	B / C	II
PAHANG/ N.SEMBILAN	PAHANG	SG. GAPOI	4PH95	Muka sauk Loji Rawatan Air Gapoi	90	B / C	II
		SG. JEMPOL	4PH96	Loji Air Sg Jerik	90	B / C	II
			4PH97	Loji Air Jengka 3	86	B / C	II
		SG. MENTIGA	4PH98	Loji Air Chini	83	B / C	II
		SG. TRIANG	4PH93	Loji Rawatan Air Sg. Triang	77	ST / SP	II
TERENGGANU	TERENGGANU	SG. TERENGGANU	4TE14	Loji Air Serada	83	B / C	II
KELANTAN	GOLOK	SG. JEDUK	4GL10	Syarikat Air Kelantan	90	B / C	II
	KELANTAN	SG. CHIKU	4KE66	Felda Ciku 2	90	B / C	II
		SG. KELANTAN	4KE68	Loji Air Kelar, Pasir Mas	81	B / C	II
		SG. PEHI	4KE67	Loji Air Pahi	85	B / C	II
SABAH	PADAS	SG. PADAS	72PD04	Water Intake Jabatan Air Beaufort	84	B / C	II

Jadual 3.6 Malaysia: Status Kualiti Air di Hulu Muka Sauk, 2013

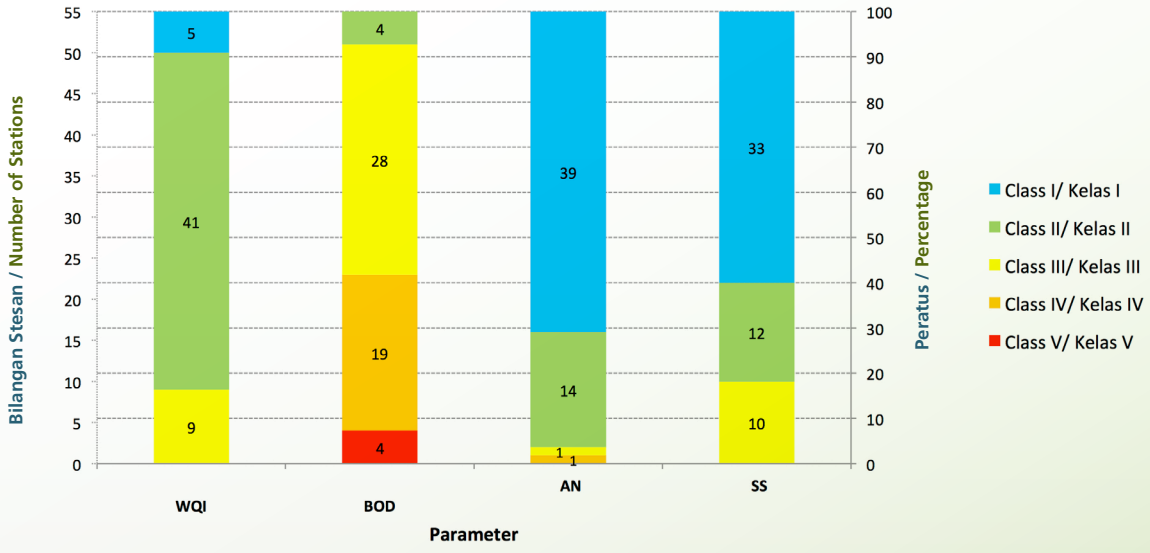
Table 3.6 Malaysia: Water Quality Status of Upstream Water Intakes, 2013

	PAPAR	SG. PAPAR	75PP04	Sekolah Kebangsaan Mandalipau	88	B / C	II
			75PP05	Water Intake Kogopon	87	B / C	II
SARAWAK	KERIAN	SG. SELALANG	55SG01	Selalang Water Intake	89	B / C	II
	MUKAH	SG. MUKAH	58MH05	Mukah Water Intake	80	ST / SP	II
	RAJANG	SG. DARO	56DR01	Daro Water Intake	60	ST / SP	III
		SG. JEMORENG	56JG01	Jemoreng Water Intake	67	ST / SP	III
		SG. PAKAN	56PN01	Pakan Water Intake	79	ST / SP	II
		SG. PILA PARIT	56PL01	Igan Water Intake	62	ST / SP	III

Jadual 3.6 Malaysia: Status Kualiti Air di Hulu Muka Sauk, 2013

Table 3.6 Malaysia: Water Quality Status of Upstream Water Intakes, 2013

Nota / Note: B/C: Bersih / Clean: ST / SP: Sederhana Tercemar / Slightly Polluted T /P: Tercemar / Polluted



Rajah 3.10: Kualiti Air Sungai Di Stesen Di Hulu Muka Sauk, 2013

Figure 3.10: River Water Quality At Stations Upstream of Water Intake, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					BOD SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
PERLIS	PERLIS	SG. TERUSAN MADA	2PS13	Loji Rawatan Air Arau Fasa IV	82	ST / SP	III
			2PS14	Loji Rawatan Air TTPC, Sg. Baru	82	ST / SP	III
KEDAH	KEDAH	SG. AHNING	2KD11	Padang Sanai	83	ST / SP	III
		SG. PDG TERAP	2KD12	Kuala Nerang	79	T / P	III
		SG. TEMIN	2KD10	Changloon	70	T / P	IV
KEDAH (LANGKAWI)	MELAKA	SG. MELAKA	2LG05	Ulu Melaka	83	ST / SP	III
		SG. SAGA	2LG06	Padang Saga	88	ST / SP	III
KEDAH/ P.PINANG	MUDA	SG. MUDA	2MD16	Jeneri	81	ST / SP	III
			2MD17	Jeniang	77	T / P	III
			2MD18	Bukit Selambau	87	ST / SP	III
			2MD20	Pinang Tunggal	84	ST / SP	III
		SG. NAMI	2MD21	Nami	72	T / P	IV
		SG. SEDIM	2MD19	Bikan	83	ST / SP	III
P.PINANG	PINANG	SG. SATU	2PG12	Batu Feringgi	92	B / C	II
PERAK	KURAU	SG. AIR HITAM	2KU07	Loji Rawatan Air Jelai	83	ST / SP	III
	PERAK	SG. MANONG	2PK62	Loji Rawatan Air Manong	73	T / P	IV
		SG. SAUK	2PK61	Loji Rawatan Air Sauk	91	B / C	II
		SG. TESONG	2PK64	Loji Rawatan Air Sg. Klah	86	ST / SP	III
		SG. WOH	2PK63	Loji Rawatan Air Kuala Woh	76	T / P	IV
	SEPETANG	SG. BATU TEGOH	2SP18	Loji Rawatan Air Bukit Larut	70	T / P	IV
SELANGOR/ PERAK	BERNAM	SG. GELINTING	1BM15	Loji Rawatan Air Ulu Slim	81	ST / SP	III
		SG. TROLAK	1BM14	Loji Rawatan Air Trolak Timur	83	ST / SP	III
SELANGOR/ PUTRAJAYA/ N.SEMBILAN	LANGAT	SG. BATANG LABU	1L26	Loji Rawatan Air Salak Tinggi	63	T / P	IV
		SG. SEMENYIH	1L09	Loji Rawatan Air Semenyih	75	T / P	IV

Jadual 3.7 Malaysia: Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks BOD, 2013

Table 3.7 Malaysia: Water Quality Status of Upstream Water Intakes Based on BOD Sub-Index, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					BOD SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
SELANGOR/ WPKL	KLANG	SG. GOMBAK	1K53	Loji Rawatan Air Gombak	92	B / C	II
MELAKA	KESANG	SG. CHIN-CHIN	1KA08	Muka sauk Loji Rawatan Air Chin-chin	65	T / P	IV
JOHOR	BATU PAHAT	SG. SEMBERONG DAM	3BP27	Semberong Dam	50	T / P	V
	BENUT	SG. MACHAP DAM	3BN10	Machap Dam	71	T / P	IV
	PULAI	SG. PULAI DAM	3PU04	Pulai Dam	80	ST / SP	III
JOHOR/ N. SEMBILAN/ PAHANG	MUAR	SG. JELAI	1MN23	Loji Rawatan Air Dangi	60	T / P	IV
		SG. JEMENTAH	3MR39	Loji Rawatan Air Jementah	84	ST / SP	III
		SG. MUAR	3MR38	Loji Rawatan Air Gombang	71	T / P	IV
PAHANG	BERTAM	SG. BERTAM	2CH15	Loji Rawatan Air Habu	74	T / P	IV
		SG. TERLA	2CH14	Loji Rawatan Air Kuala Terla	75	T / P	IV
		SG. ULONG	2CH16	Brinchang Dam	79	T / P	III
PAHANG/ JOHOR	ENDAU	SG. KAHANG	3ED38	Jalan Felda Kahang Timur, Kluang	70	T / P	IV
PAHANG/ N.SEMBILAN	PAHANG	SG. GAPOI	4PH95	Muka sauk Loji Rawatan Air Gapoi	78	T / P	III
		SG. JEMPOL	4PH96	Loji Air Sg Jerik	82	ST / SP	III
			4PH97	Loji Air Jengka 3	82	ST / SP	III
		SG. MENTIGA	4PH98	Loji Air Chini	78	T / P	III
		SG. TRIANG	4PH93	Loji Rawatan Air Sg. Triang	61	T / P	IV
TERENGGANU	TERENGGANU	SG. TERENGGANU	4TE14	Loji Air Serada	76	T / P	IV
KELANTAN	GOLOK	SG. JEDUK	4GL10	Syarikat Air Kelantan	84	ST / SP	III
	KELANTAN	SG. CHIKU	4KE66	Felda Ciku 2	86	ST / SP	III
		SG. KELANTAN	4KE68	Loji Air Kelar, Pasir Mas	79	T / P	III
		SG. PEHI	4KE67	Loji Air Pahi	81	ST / SP	III

Jadual 3.7 Malaysia: Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks BOD, 2013

Table 3.7 Malaysia: Water Quality Status of Upstream Water Intakes Based on BOD Sub-Index, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					BOD SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
SABAH	PADAS	SG. PADAS	72PD04	Water Intake Jabatan Air Beaufort	80	ST / SP	III
	PAPAR	SG. PAPAR	75PP04	Sekolah Kebangsaan Mandalipau	82	ST / SP	III
			75PP05	Water Intake Kogopon	77	T / P	IV
SARAWAK	KERIAN	SG. SELALANG	55SG01	Selalang Water Intake	89	ST / SP	II
	MUKAH	SG. MUKAH	58MH05	Mukah Water Intake	76	T / P	IV
	RAJANG	SG. DARO	56DR01	Daro Water Intake	22	T / P	V
		SG. JEMORENG	56JG01	Jemoreng Water Intake	34	T / P	V
		SG. PAKAN	56PN01	Pakan Water Intake	71	T / P	IV
		SG. PILA PARIT	56PL01	Igan Water Intake	30	T / P	V

Jadual 3.7 Malaysia: Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks BOD, 2013

Table 3.7 Malaysia: Water Quality Status of Upstream Water Intakes Based on BOD Sub-Index, 2013

Nota / Note: B/C: Bersih / Clean: ST / SP: Sederhana Tercemar / Slightly Polluted T /P: Tercemar / Polluted

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					AN SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
PERLIS	PERLIS	SG. TERUSAN MADA	2PS13	Loji Rawatan Air Arau Fasa IV	95	B / C	I
			2PS14	Loji Rawatan Air TTPC, Sg. Baru	87	ST / SP	II
KEDAH	KEDAH	SG. AHNING	2KD11	Padang Sanai	83	ST / SP	II
		SG. PDG TERAP	2KD12	Kuala Nerang	96	B / C	I
		SG. TEMIN	2KD10	Changloon	77	ST / SP	II
KEDAH (LANGKAWI)	MELAKA	SG. MELAKA	2LG05	Ulu Melaka	91	ST / SP	I
		SG. SAGA	2LG06	Padang Saga	90	ST / SP	II
KEDAH / P.PINANG	MUDA	SG. MUDA	2MD16	Jeneri	94	B / C	I
			2MD17	Jeniang	95	B / C	I
			2MD18	Bukit Selambau	95	B / C	I
			2MD20	Pinang Tunggal	84	ST / SP	II
		SG. NAMI	2MD21	Nami	96	B / C	I
		SG. SEDIM	2MD19	Bikan	97	B / C	I
P.PINANG	PINANG	SG. SATU	2PG12	Batu Feringgi	101	B / C	I
PERAK	KURAU	SG. AIR HITAM	2KU07	Loji Rawatan Air Jelai	99	B / C	I
	PERAK	SG. MANONG	2PK62	Loji Rawatan Air Manong	100	B / C	I
		SG. SAUK	2PK61	Loji Rawatan Air Sauk	101	B / C	I
		SG. TESONG	2PK64	Loji Rawatan Air Sg. Klah	99	B / C	I
		SG. WOH	2PK63	Loji Rawatan Air Kuala Woh	86	ST / SP	II
	SEPETANG	SG. BATU TEGOH	2SP18	Loji Rawatan Air Bukit Larut	99	B / C	I
SELANGOR/ PERAK	BERNAM	SG. GELINTING	1BM15	Loji Rawatan Air Ulu Slim	99	B / C	I
		SG. TROLAK	1BM14	Loji Rawatan Air Trolak Timur	98	B / C	I
SELANGOR/ PUTRAJAYA/ N.SEMBILAN	LANGAT	SG. BATANG LABU	1L26	Loji Rawatan Air Salak Tinggi	49	T / P	IV
		SG. SEMENYIH	1L09	Loji Rawatan Air Semenyih	60	T / P	III

Jadual 3.8 Malaysia: Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks AN, 2013

Table 3.8 Malaysia: Water Quality Status of Upstream Water Intakes Based on AN Sub-Index, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					AN SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
SELANGOR/ WPKL	KLANG	SG. GOMBAK	1K53	Loji Rawatan Air Gombak	100	B / C	I
MELAKA	KESANG	SG. CHIN-CHIN	1KA08	Muka sauk Loji Rawatan Air Chin-chin	80	ST / SP	II
JOHOR	BATU PAHAT	SG. SEMBERONG DAM	3BP27	Semberong Dam	90	ST / SP	II
	BENUT	SG. MACHAP DAM	3BN10	Machap Dam	101	B / C	I
	PULAI	SG. PULAI DAM	3PU04	Pulai Dam	92	B / C	I
JOHOR/ N. SEMBILAN/ PAHANG	MUAR	SG. JELAI	1MN23	Loji Rawatan Air Dangi	80	ST / SP	II
		SG. JEMENTAH	3MR39	Loji Rawatan Air Jementah	98	B / C	I
		SG. MUAR	3MR38	Loji Rawatan Air Gombang	73	ST / SP	II
PAHANG	BERTAM	SG. BERTAM	2CH15	Loji Rawatan Air Habu	100	B / C	I
		SG. TERLA	2CH14	Loji Rawatan Air Kuala Terla	100	B / C	I
		SG. ULONG	2CH16	Brinchang Dam	98	B / C	I
PAHANG/ JOHOR	ENDAU	SG. KAHANG	3ED38	Jalan Felda Kahang Timur, Kluang	99	B / C	I
PAHANG/ N.SEMBILAN	PAHANG	SG. GAPOI	4PH95	Muka sauk Loji Rawatan Air Gapoi	98	B / C	I
		SG. JEMPOL	4PH96	Loji Air Sg Jerik	98	B / C	I
			4PH97	Loji Air Jengka 3	97	B / C	I
		SG. MENTIGA	4PH98	Loji Air Chini	91	ST / SP	I
		SG. TRIANG	4PH93	Loji Rawatan Air Sg. Triang	98	B / C	I
TERENGGANU	TERENGGANU	SG. TERENGGANU	4TE14	Loji Air Serada	87	ST / SP	II
KELANTAN	GOLOK	SG. JEDUK	4GL10	Syarikat Air Kelantan	93	B / C	I
	KELANTAN	SG. CHIKU	4KE66	Felda Ciku 2	92	B / C	I
		SG. KELANTAN	4KE68	Loji Air Kelar, Pasir Mas	94	B / C	I
		SG. PEHI	4KE67	Loji Air Pahi	96	B / C	I

Jadual 3.8 Malaysia: Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks AN, 2013

Table 3.8 Malaysia: Water Quality Status of Upstream Water Intakes Based on AN Sub-Index, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					AN SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
SABAH	PADAS	SG. PADAS	72PD04	Water Intake Jabatan Air Beaufort	89	ST / SP	II
	PAPAR	SG. PAPAR	75PP04	Sekolah Kebangsaan Mandalipau	92	B / C	I
			75PP05	Water Intake Kogopon	92	B / C	I
SARAWAK	KERIAN	SG. SELALANG	55SG01	Selalang Water Intake	89	ST / SP	II
	MUKAH	SG. MUKAH	58MH05	Mukah Water Intake	96	B / C	I
	RAJANG	SG. DARO	56DR01	Daro Water Intake	96	B / C	I
		SG. JEMORENG	56JG01	Jemoreng Water Intake	97	B / C	I
		SG. PAKAN	56PN01	Pakan Water Intake	94	B / C	I
		SG. PILA PARIT	56PL01	Igan Water Intake	83	ST / SP	II

Jadual 3.8 Malaysia: Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks AN, 2013

Table 3.8 Malaysia: Water Quality Status of Upstream Water Intakes Based on AN Sub-Index, 2013

Nota / Note: B/C: Bersih / Clean: ST / SP: Sederhana Tercemar / Slightly Polluted T /P: Tercemar / Polluted

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					SS SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
PERLIS	PERLIS	SG. TERUSAN MADA	2PS13	Loji Rawatan Air Arau Fasa IV	72	ST / SP	III
			2PS14	Loji Rawatan Air TTPC, Sg. Baru	74	ST / SP	II
KEDAH	KEDAH	SG. AHNING	2KD11	Padang Sanai	95	B / C	I
		SG. PDG TERAP	2KD12	Kuala Nerang	87	B / C	I
		SG. TEMIN	2KD10	Changloon	65	T / P	III
KEDAH (LANGKAWI)	MELAKA	SG. MELAKA	2LG05	Ulu Melaka	90	B / C	I
		SG. SAGA	2LG06	Padang Saga	92	B / C	I
KEDAH/ P.PINANG	MUDA	SG. MUDA	2MD16	Jeneri	67	T / P	III

Jadual 3.9 Malaysia: Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks SS, 2013

Table 3.9 Malaysia: Water Quality Status of Upstream Water Intakes Based on SS Sub-Index, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					SS SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
			2MD17	Jeniang	77	B / C	II
			2MD18	Bukit Selambau	69	T / P	III
			2MD20	Pinang Tunggal	70	ST / SP	III
		SG. NAMI	2MD21	Nami	78	B / C	II
		SG. SEDIM	2MD19	Bikan	77	B / C	II
P.PINANG	PINANG	SG. SATU	2PG12	Batu Feringgi	98	B / C	I
PERAK	KURAU	SG. AIR HITAM	2KU07	Loji Rawatan Air Jelai	98	B / C	I
	PERAK	SG. MANONG	2PK62	Loji Rawatan Air Manong	97	B / C	I
		SG. SAUK	2PK61	Loji Rawatan Air Sauk	98	B / C	I
		SG. TESONG	2PK64	Loji Rawatan Air Sg. Klah	97	B / C	I
		SG. WOH	2PK63	Loji Rawatan Air Kuala Woh	97	B / C	I
	SEPETANG	SG. BATU TEGOH	2SP18	Loji Rawatan Air Bukit Larut	96	B / C	I
SELANGOR/ PERAK	BERNAM	SG. GELINTING	1BM15	Loji Rawatan Air Ulu Slim	96	B / C	I
		SG. TROLAK	1BM14	Loji Rawatan Air Trolak Timur	97	B / C	I
SELANGOR/ PUTRAJAYA/ N.SEMBILAN	LANGAT	SG. BATANG LABU	1L26	Loji Rawatan Air Salak Tinggi	80	B / C	II
		SG. SEMENYIH	1L09	Loji Rawatan Air Semenyih	81	B / C	II
SELANGOR/ WPKL	KLANG	SG. GOMBAK	1K53	Loji Rawatan Air Gombak	97	B / C	I
MELAKA	KESANG	SG. CHIN-CHIN	1KA08	Muka sauk Loji Rawatan Air Chin-chin	71	ST / SP	III
JOHOR	BATU PAHAT	SG. SEMBERONG DAM	3BP27	Semberong Dam	93	B / C	I
	BENUT	SG. MACHAP DAM	3BN10	Machap Dam	96	B / C	I
	PULAI	SG. PULAI DAM	3PU04	Pulai Dam	97	B / C	I
JOHOR/ N. SEMBILAN/ PAHANG	MUAR	SG. JELAI	1MN23	Loji Rawatan Air Dangi	76	B / C	II
		SG. JEMENTAH	3MR39	Loji Rawatan Air Jementah	93	B / C	I

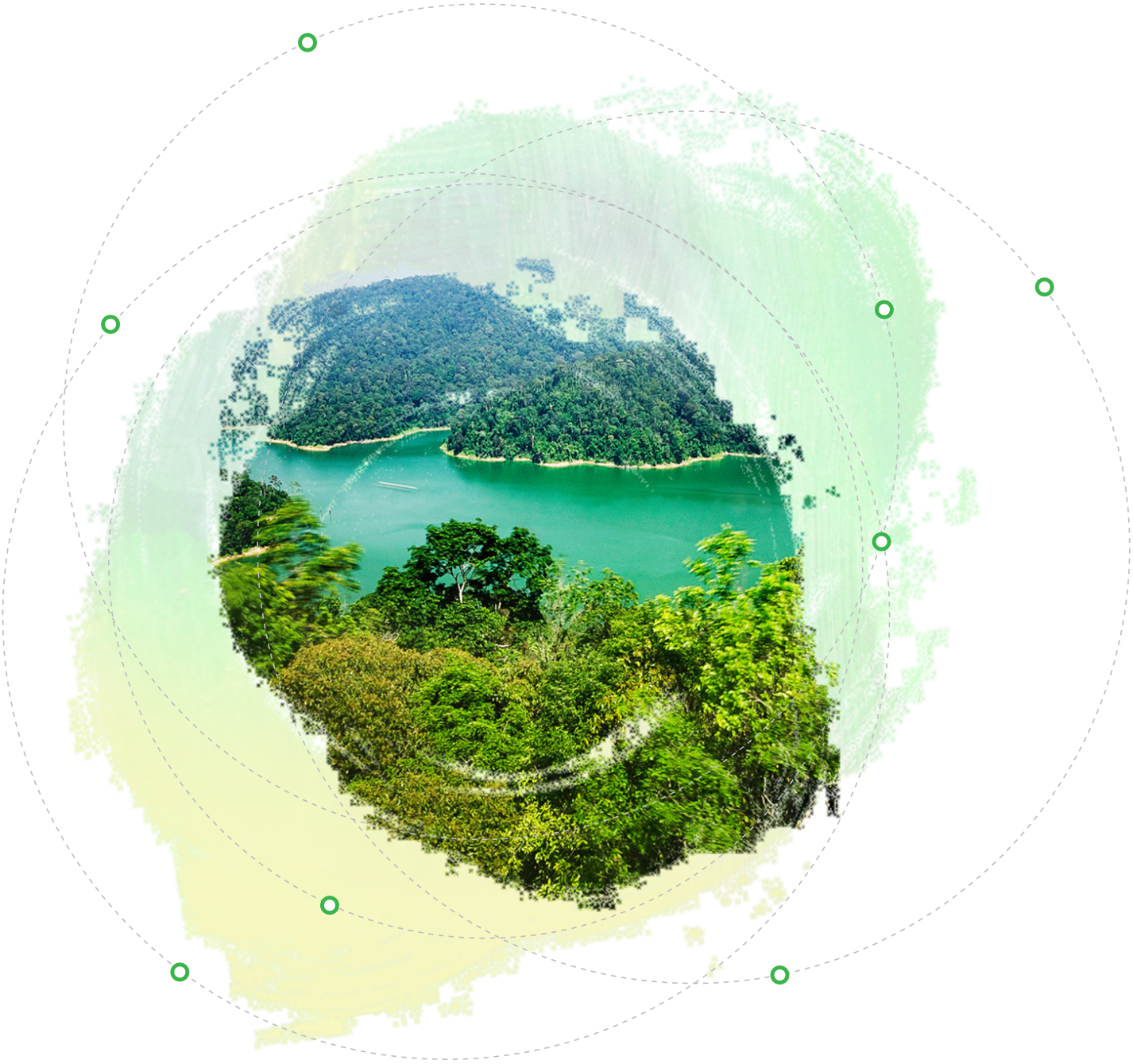
Jadual 3.9 Malaysia: Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks SS, 2013

Table 3.9 Malaysia: Water Quality Status of Upstream Water Intakes Based on SS Sub-Index, 2013

NEGERI / STATE	LEMBANGAN SUNGAI / RIVER BASIN	SUNGAI / RIVER	STESEN ID / ID STESEN	MUKA SAUK / WATER INTAKE	KUALITI AIR, 2013/ WATER QUALITY 2013		
					SS SUB-INDEX	KATEGORI / CATEGORY	KELAS/ CLASS
		SG. MUAR	3MR38	Loji Rawatan Air Gombang	77	B / C	II
PAHANG	BERTAM	SG. BERTAM	2CH15	Loji Rawatan Air Habu	96	B / C	I
		SG. TERLA	2CH14	Loji Rawatan Air Kuala Terla	92	B / C	I
		SG. ULONG	2CH16	Brinchang Dam	96	B / C	I
PAHANG/ JOHOR	ENDAU	SG. KAHANG	3ED38	Jalan Felda Kahang Timur, Kluang	85	B / C	I
PAHANG/ N.SEMBILAN	PAHANG	SG. GAPOI	4PH95	Muka sauk Loji Rawatan Air Gapoi	96	B / C	I
		SG. JEMPOL	4PH96	Loji Air Sg Jerik	92	B / C	I
			4PH97	Loji Air Jengka 3	72	ST / SP	II
		SG. MENTIGA	4PH98	Loji Air Chini	75	ST / SP	II
		SG. TRIANG	4PH93	Loji Rawatan Air Sg. Triang	57	T / P	III
TERENGGANU	TERENGGANU	SG. TERENGGANU	4TE14	Loji Air Serada	87	B / C	I
KELANTAN	GOLOK	SG. JEDUK	4GL10	Syarikat Air Kelantan	92	B / C	I
	KELANTAN	SG. CHIKU	4KE66	Felda Ciku 2	93	B / C	I
		SG. KELANTAN	4KE68	Loji Air Kelar, Pasir Mas	58	T / P	III
		SG. PEHI	4KE67	Loji Air Pahi	68	T / P	III
SABAH	PADAS	SG. PADAS	72PD04	Water Intake Jabatan Air Beaufort	59	T / P	III
	PAPAR	SG. PAPAR	75PP04	Sekolah Kebangsaan Mandalipau	88	B / C	I
			75PP05	Water Intake Kogopon	85	B / C	I
SARAWAK	KERIAN	SG. SELALANG	55SG01	Selalang Water Intake	91	B / C	I
	MUKAH	SG. MUKAH	58MH05	Mukah Water Intake	82	B / C	II
	RAJANG	SG. DARO	56DR01	Daro Water Intake	91	B / C	I
		SG. JEMORENG	56JG01	Jemoreng Water Intake	87	B / C	I
		SG. PAKAN	56PN01	Pakan Water Intake	86	B / C	I
		SG. PILA PARIT	56PL01	Igan Water Intake	83	B / C	II

Jadual 3.9 Malaysia: Status Kualiti Air di Hulu Muka Sauk Berdasarkan Sub-Indeks SS, 2013

Table 3.9 Malaysia: Water Quality Status of Upstream Water Intakes Based on SS Sub-Index, 2013



BAB 4
CHAPTER

KUALITI AIR TANAH / GROUNDWATER QUALITY

PENGAWASAN KUALITI AIR TANAH

Program Pengawasan Kualiti Air Tanah Kebangsaan telah dimulakan pada tahun 1997 dan pada masa ini program pengawasan telah dijalankan terhadap 78 telaga pengawasan di Semenanjung Malaysia, 12 telaga di Sarawak dan 15 telaga di Sabah **(Jadual 4.1).** Tapak telaga yang telah terpilih adalah mewakili jenis guna tanah spesifik seperti pertanian, bandar/pinggir bandar, luar bandar dan industri serta tapak yang berkepentingan tertentu seperti tapak pelupusan sampah, padang golf, kawasan pelupusan bangkai haiwan, bekalan air tempatan dan juga bekas lombong emas.

Pada tahun 2013, sebanyak 380 sampel telah diambil daripada telaga pengawasan aktif ini dan telah dianalisa untuk bahan kimia organik meruap (VOCs), racun perosak, logam berat, anion, bakteria (kolifom), sebatian berfenol, jumlah keliatan, jumlah pepejal terlarut, pH, suhu, konduktiviti dan oksigen terlarut (DO).

GROUND WATER QUALITY MONITORING

The National Ground Water Monitoring Programme was established in 1997 and presently monitoring programme being carried out at 78 wells in Peninsular Malaysia, 12 wells in Sarawak and 15 wells in Sabah **(Table 4.1)**. The sites were selected based on specific land uses such as agricultural, urban/suburban, rural, industrial and sites of special interests such as solid waste landfills, golf courses, animal burial areas, municipal water supply and ex-mining (gold mine).

In 2013, 380 water samples were taken from these monitoring wells and analyzed 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).

Hasil analisis dibandingkan dengan Garis Panduan Kebangsaan Bagi Kualiti Air Mentah Untuk Minuman yang telah dibangunkan oleh Kementerian Kesihatan (Semakan Disember 2000) **(Jadual 4.2)** bagi menentukan status kualiti air tanah.

The results were then compared with the National Guidelines for Raw Drinking Water Quality established by the Ministry of Health (Revised December 2000) **(Table 4.2)** to determine the status of the quality of groundwater.

Kategori / Category	Bilangan Telaga / Numbers of Wells
Kawasan Pertanian / Agricultural Areas	12
Bandar & Pinggir Bandar / Urban / Suburban Areas	11
Tapak Perindustrian / Industrial Sites	18
Tapak Pelupusan Sampah / Solid Waste Landfills	23
Padang Golf / Golf Courses	7
Luar Bandar / Rural Areas	3
Bekas Lombong Emas / Ex- mining Areas (Gold Mine)	3
Bekalan Air Tempatan / Municipal Water Supply	6
Tapak Pelupusan Bangkai Haiwan / Animal Burial Areas	14
Kolam Akuakultur/ Aquaculture Farms	6
Tapak Pelupusan Radioaktif / Radioactive Landfill	1
Peranginan / Resorts	1
Jumlah / Total	**105**

Jadual 4.1 Malaysia: Bilangan Telaga Air Tanah Mengikut Jenis Kategori Guna Tanah, 2013
Table 4.1 Malaysia : Number of Groundwater Wells by Land Use Category, 2013

Parameter / Parameter	Simbol / Symbol	Unit / Unit	Had Piawai / Benchmark
Sulfat / Sulphate	SO_4^-	mg/l	250
Keliatan / Hardness	$CaCO_3$	mg/l	500
Nitrat / Nitrate	NO_3^-	mg/l	10
Kolifom / Total Coliform	-	MPN/100ml	Mesti tidak dikesan dalam sebarang 100ml sampel Must not be detected in any 100ml sample
Mangan / Manganese	Mn	mg/l	0.1
Kromium / Chromium	Cr	mg/l	0.05
Zink / Zinc	Zn	mg/l	3
Arsenik / Arsenic	As	mg/l	0.01
Selenium / Selenium	Se	mg/l	0.01
Klorida / Chloride	Cl	mg/l	250
Sebatian Fenol / Phenolics	-	mg/l	0.002
Pepejal Terlarut / TDS	-	mg/l	1000
Besi / Iron	Fe	mg/l	0.3
Kuprum / Copper	Cu	mg/l	1.0
Plumbum / Lead	Pb	mg/l	0.01
Kadmium / Cadmium	Cd	mg/l	0.003
Merkuri / Mercury	Hg	mg/l	0.001

Jadual 4.2 Malaysia: Garis Panduan Kebangsaan Bagi Kualiti Air Mentah Untuk Minuman (Semakan Disember 2000)

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

Sumber: Kementerian Kesihatan Malaysia (Tahun 2000)

Source: Ministry of Health, Malaysia (2000)

STATUS KUALITI AIR TANAH

Penilaian turut dibuat terhadap kualiti air tanah berdasarkan kepada nilai peratusan yang melebihi had piawai dalam Garis Panduan Kebangsaan bagi Kualiti Air Mentah untuk Minuman, 2000 (NGRDWQ). Peratusan julat di antara 0% to 49% adalah dikategorikan sebagai "rendah"; 50 - 79% sebagai "sederhana"; dan 80 - 100% sebagai "tinggi".

Oleh kerana JAS masih belum membangunkan standard & kriteria air tanah, maka kita telah merujuk dan mengguna pakai NGRDWQ dari Kementerian Kesihatan Malaysia bagi mendapatkan nilai penerimaan maksimum bagi menganalisis kandungan parameter-parameter dalam air minuman mentah yang diambil dari dalam tanah.

Pada tahun 2013, keputusan yang diperolehi daripada pengawasan yang dijalankan menunjukkan bahawa semua stesen berada dalam julat nilai pematuhan NGRDWQ kecuali bagi arsenik (As), besi (Fe), mangan (Mn), jumlah kolifom dan juga fenol **(Rajah 4.1) .**

Dari segi parameter yang melebihi NGRDWQ, didapati jumlah kolifom adalah dikategorikan sebagai tinggi di semua stesen diikuti fenol, Fe , Mn and As. Analisis lanjut diberikan dalam **Jadual 4.3.**

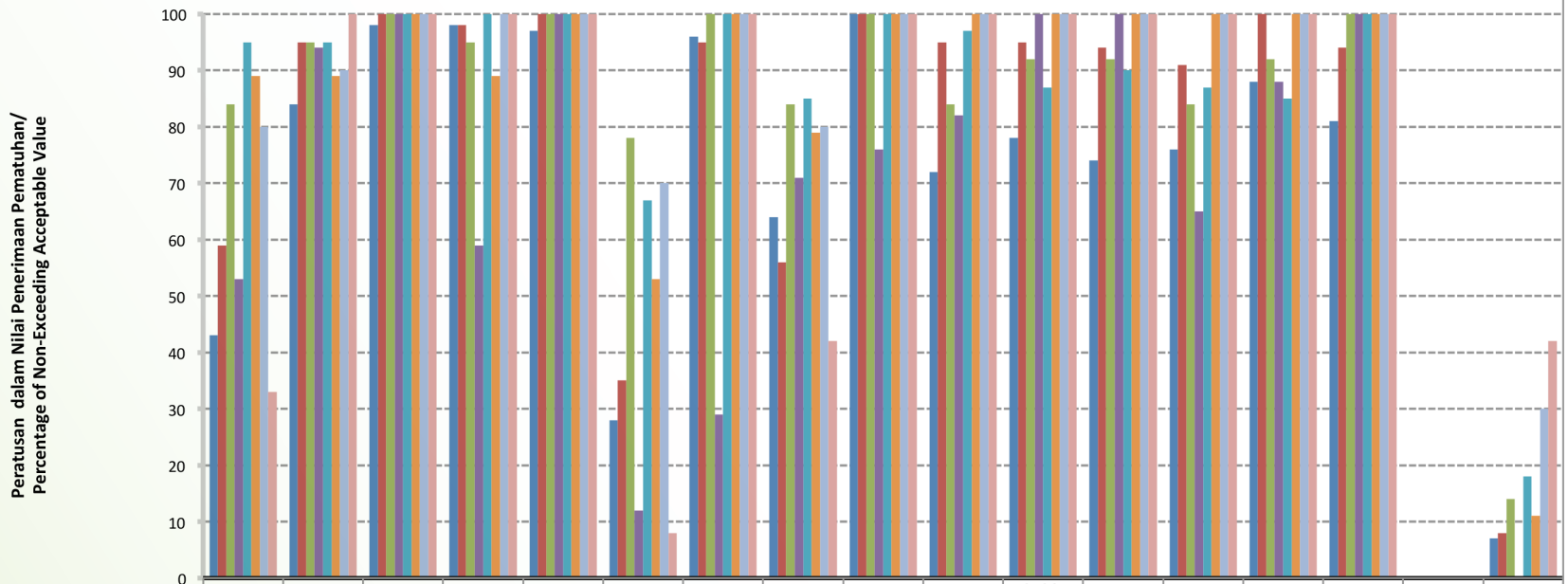
GROUND WATER QUALITY STATUS

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

As the DOE had yet to develop any groundwater standards and criteria, the department had to refer to and use NGRDWQ from the Ministry of Health, in obtaining the maximum acceptable parameter value for analyzing raw drinking water from soil.

In 2013, the results derived from the monitoring showed that all stations were within the NGRDWQ values except for arsenics (As), iron (Fe), manganese (Mn), total coliform and phenol **(Figure 4.1).**

From parameters exceeding NGRDWQ standards, coliform was categorized as the highest in all the stations, followed by phenol, Fe , Mn and As. Detailed analysis is shown in **(Table 4.3).**



	As	Hg	Cd	Cr	Cu	Fe	Pb	Mn	Zn	Se	$CaCO_3$	TDS	Cl	NO3	SO4	T-Coliform	Phenol
Industri/Industri	43	84	98	98	97	28	96	64	100	72	78	74	76	88	81	0	7
Tapak pelupusan sampah/Landfill	59	95	100	98	100	35	95	56	100	95	95	94	91	100	94	0	8
Pertanian/Agriculture	84	95	100	95	100	78	100	84	100	84	92	92	84	92	100	0	14
Bekalan Air Tempatan/Municipal Water Supply	53	94	100	59	100	12	29	71	76	82	100	100	65	88	100	0	0
Bandar/Pinggir Bandar/Urban/Suburban	95	95	100	100	100	67	100	85	100	97	87	90	87	85	100	0	18
Padang Golf/Golf Courses	89	89	100	89	100	53	100	79	100	100	100	100	100	100	100	0	11
Luar Bandar/Rural Areas	80	90	100	100	100	70	100	80	100	100	100	100	100	100	100	0	30
Bekas Lombong/Ex-mining	33	100	100	100	100	8	100	42	100	100	100	100	100	100	100	0	42

Rajah 4.1 Malaysia: Peratusan Pematuhan oleh Pencemar Terpilih Mengikut Guna Tanah, 2013

Figure 4.1 Malaysia: Percentage of Compliance of Selected Contaminants by Land Use, 2013

Negeri / State	Bilangan Stesen / No. of Station	Maklumat Stesen / Station Description	Nilai Peratusan yang Melebihi NGRDWQ (%) / The Percentage of Exceedance NGRDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Sabah	15	1) Labuan	67	100	33	100	100
		2) ITAC, Penampang (1)	0	67	67	100	100
		3) ITAC, Penampang(2)	0	100	100	100	100
		4) ITAC, Penampang (3)	0	0	100	100	100
		5) ITAC, Penampang (4)	0	0	100	100	100
		6) ITAC, Penampang(5)	33	100	67	100	100
		7) ITAC, Penampang(6)	100	100	50	100	100
		8) ITAC, Penampang(7)	50	50	0	100	100
		9) Limbawang	0	0	0	100	100
		10)Tawau	0	0	0	100	100
		11) Kg. Tajau Laut	100	100	100	100	100
		12) Sandakan Golf Club no.1	0	0	0	100	100
		13) Sandakan Golf Club no.2	0	0	0	100	100
		14) Inanam	50	100	50	100	100
		15) Pulau Manukan	0	0	0	100	100
Sarawak	12	1) Kemuyang no.1	0	100	100	100	100
		2) Kemuyang no.2	25	75	0	100	100
		3) Kabong	75	75	75	100	100
		4) Kuala Lawas no.1	0	100	0	100	100
		5) Kuala Lawas no.2	0	67	0	100	100
		6) Laku	33	100	0	100	100
		7) Kg. Lusut Kiri	100	100	33	100	100
		8) Bau no.1	100	100	100	100	50
		9) Bau no.2	100	100	75	100	25
		10) Bau	0	75	0	100	50
		11) Oya no.1	0	100	25	100	100
		12) Oya no.2	0	75	100	100	100

Jadual 4.3 Malaysia: Peratusan yang Melebihi NGRDWQ mengikut Negeri, 2013

Table 4.3 Malaysia : Percentage of Exceedance NGRDWQ by State, 2013

Negeri / State	Bilangan Stesen / No. of Station	Maklumat Stesen / Station Description	Nilai Peratusan yang Melebihi NGRDWQ (%) / The Percentage of Exceedance NGRDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Terengganu	13	1) Kerteh no.1	33	0	0	100	75
		2) Kerteh no.2	0	100	0	100	100
		3) Telok Kalong no.1	0	100	0	100	67
		4) Telok Kalong no.2	33	100	100	100	67
		5) Kg. Kubang Badak no.1, K.Treg	0	0	0	100	67
		6) Kg. Kubang Badak no.2, K.Treg	0	100	0	100	33
		7) Kg. Merang,Setiu	0	0	0	100	50
		8) Kg. Alor Peroi no.1	0	33	0	100	100
		9) Kg. Alor Peroi no.2	0	100	100	100	67
		10) Kg. Alor Peroi no.3	33	100	100	100	75
		11) Kg. Raja no.1 , Besut	0	0	0	100	50
		12) Kg. Raja no.2, Besut	0	100	0	100	25
		13) Bukit Payung, Marang	0	0	0	100	50
Pahang	8	1) Nenasi	25	100	100	100	100
		2) Lepar	0	25	0	100	100
		3) Agrobest no.2, Nenasi	0	100	0	100	100
		4) Agrobest no.3, Nenasi	25	100	100	100	100
		5) Agrobest no.4, Nenasi	25	100	50	100	100
		6) Agrobest no.5, Nenasi	0	75	0	100	100
		7) Agrobest no.6, Nenasi	0	100	100	100	100
		8) Agrobest no.7, Nenasi	100	100	0	100	100
Johor	6	1) Tg. Puteri, Pasir Gudang (MUCC)	67	67	67	100	100
		2) Tg. Puteri, Pasir Gudang	100	100	33	100	100
		3) Kota Tinggi	100	67	67	100	100
		4) Ulu Choh (Pintu)	100	100	67	100	100
		5) Ulu Choh (Kolam)	100	100	0	100	100
		6) Ulu Choh (Sungai)	100	100	0	100	100
Kedah	4	1) Kulim Hi-tech	100	100	0	100	100
		2) Kepala Batas	0	100	0	100	100
		3) Pulau Langkawi no.1	25	0	0	100	100
		4) Pulau Langkawi no.2	75	0	0	100	100

Jadual 4.3 Malaysia: Peratusan yang Melebihi NGRDWQ mengikut Negeri, 2013

Table 4.3 Malaysia : Percentage of Exceedance NGRDWQ by State, 2013

Negeri / State	Bilangan Stesen / No. of Station	Maklumat Stesen / Station Description	Nilai Peratusan yang Melebihi NGRDWQ (%) / The Percentage of Exceedance NGRDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Perlis	3	1) Arau no.1	0	75	0	100	75
		2) Arau no.2	0	25	25	100	100
		3) Padang Besar	0	0	0	100	100
Kelantan	15	1) Eastern Garment MFG no.1	0	0	0	100	100
		2) Eastern Garment MFG no.2	33	33	33	100	67
		3) Panji no.1	33	0	0	100	33
		4) Panji no.2	33	0	0	100	67
		5) Pasir Mas	0	100	100	100	67
		6) Kampong Jembal	67	0	0	100	100
		7) Beris Lalang	0	0	0	100	67
		8) Rantau Panjang no.1	0	0	0	100	100
		9) Rantau Panjang no.2	0	0	0	100	67
		10) Kelab Golf DiRaja Kubang Kerian no.1	33	67	67	100	100
		11) Kelab Golf DiRaja Kubang Kerian no.2	0	33	33	100	100
		12) Kelab Golf & Desa no.1	33	100	0	100	67
		13) Kelab Golf & Desa no.2	0	100	33	100	67
		14) Bachok no.1	0	0	0	100	67
		15) Bachok no.2	0	100	67	100	100
Melaka	1	1) Petronas Sungai Udang	100	100	67	100	100
Perak	4	1) Batu Gajah	100	100	0	100	100
		2) Tambun	100	75	0	100	100
		3) Jalong no.1	0	0	0	100	100
		4) Jalong no.2	0	50	50	100	100
Kuala Lumpur	6	1) Jln. Sungai Besi no.1	100	100	100	100	100
		2) Jln. Sungai Besi no.2	67	67	67	100	100
		3) Jln. Sungai Besi no.3	0	0	0	100	100
		4) Taman Beringin no.1	100	100	100	100	100
		5) Taman Beringin no.2	100	100	50	100	100
		6) Royal Selangor Golf Club	0	0	0	100	100

Jadual 4.3 Malaysia: Peratusan yang Melebihi NGRDWQ mengikut Negeri, 2013

Table 4.3 Malaysia : Percentage of Exceedance NGRDWQ by State, 2013

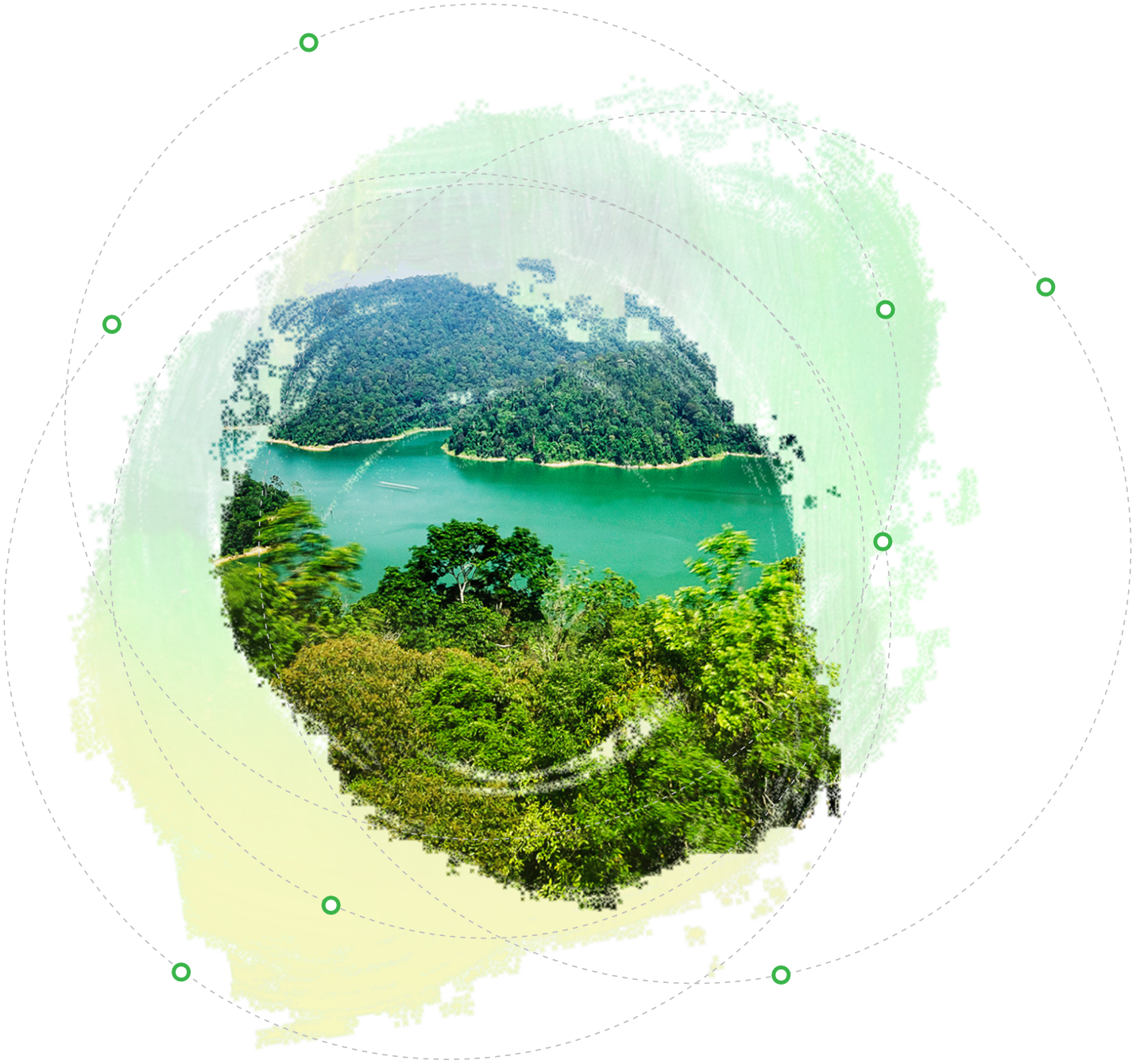
Negeri / State	Bilangan Stesen / No. of Station	Maklumat Stesen / Station Description	Nilai Peratusan yang Melebihi NGRDWQ (%) / The Percentage of Exceedance NGRDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Selangor	8	1) Sek Keb Seksyen 20,Shah Alam	50	100	0	100	100
		2) CIAST no.1, Shah Alam	25	100	100	100	100
		3) CIAST no.2, Shah Alam	75	100	100	100	100
		4) Saujana Golf Resort no.1, Subang	0	0	0	100	100
		5) Saujana Golf Resort no.2, Subang	0	0	0	100	100
		6) Rumah India, Sepang	100	100	0	100	100
		7) TNB Sepang	0	0	0	100	100
		8) Ladang Sepang	0	75	0	100	100
Pulau Pinang	6	1) Mak Mandin no.1	100	67	33	100	100
		2) Mak Mandin no.2	100	0	67	100	100
		3) Bayan Lepas	67	67	0	100	100
		4) Valdor (Kelapa)	33	67	33	100	100
		5) Valdor (Tengah)	0	67	33	100	100
		6) Valdor (Jalan)	33	100	0	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	0	100	100

Jadual 4.3 Malaysia: Peratusan yang Melebihi NGRDWQ mengikut Negeri, 2013

Table 4.3 Malaysia : Percentage of Exceedance NGRDWQ by State, 2013

Stesen Pengawasan Kualiti Air Tanah di Felda Rimba Mas, Padang Besar (guna tanah pertanian)

Groundwater Monitoring Station at Felda Rimba Mas, Padang Besar (for agriculture land use)



BAB 5
CHAPTER

KUALITI AIR MARIN DAN PULAU-PULAU / ISLANDS AND MARINE WATER QUALITY

PENGAWASAN KUALITI AIR MARIN

Jabatan Alam Sekitar (JAS) menjalankan pengawasan kualiti air marin bermula pada tahun 1978 di Semenanjung Malaysia dan 1985 bagi Sabah dan Sarawak dengan tujuan untuk mengenalpasti status kualiti air marin dan menentukan tahap pencemaran daripada punca-punca di daratan dan juga di laut. Punca-punca pencemaran ini boleh menimbulkan ancaman kepada sumber kehidupan marin dan mengganggu kestabilan dan kepelbagaian ekosistem marin.

Dalam tahun 2013, sebanyak 155 stesen pantai, 76 stesen kuala dan 90 stesen pulau telah dipantau. Sebanyak 648 sampel di kawasan pantai, 334 di kuala dan 327 di pulau telah diambil untuk dianalisa dan hasilnya dilaporkan berdasarkan Indeks Kualiti Air Marin (IKAM)(Annex).

MARINE WATER QUALITY MONITORING

The Department of Environment (DOE) continues to monitor the quality of marine water since 1978 for Peninsular Malaysia and 1985 for Sabah and Sarawak, with the principal aim of identifying the quality of marine water status and to determine the degree of pollution from both land-based sources as well as the seas. These sources may pose threats to marine resources and can upset the stability and diversity of its ecosystem.

In 2013, 155 coastal, 76 estuary and 90 island monitoring stations were monitored, a total of 648 samples from coastal, 334 samples from estuary and 327 samples from island monitoring stations were collected, analyzed and reported based on the Marine Water Quality Index (MWQI)(ANNEX).

IKAM digunakan sebagai satu cara untuk menggambarkan kategori dan status kualiti air marin. Indeks ini dibangunkan berdasarkan tujuh (7) parameter utama iaitu Oksigen Terlarut (DO), Nitrat (NO_3), Fosfat (PO_4), Ammonia Tidak Terion(NH_3), Faecal Coliform, Minyak dan Gris (O&G) dan Jumlah Pepejal Terampai (TSS).

IKAM yang berskala 0 hingga 100 akan menentukan kategori kualiti air marin daripada "Terbaik" hingga "Tercemar" **(Jadual 5.1).**

The MWQI was used as a benchmark to reflect the quality of marine water status and categories. The index was developed based on seven (7) main parameters consisting of 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).

MWQI with scales between 0 to 100, will be used to designate the assigned categories of water quality, ranging from "Excellent" to "Poor" **(Table 5.1).**

KATEGORI / CATEGORY	NILAI INDEKS / INDEX VALUE
Terbaik / Excellent	90 -100
Baik / Good	80 - <90
Sederhana / Moderate	50 - <80
Tercemar / Poor	0 - <50

Jadual 5.1: Klasifikasi Indeks Kualiti Air Marin

Table 5.1: Marine Water Quality Index Classification

PARAMETER/ PARAMETER	KELAS 1/ CLASS 1	KELAS 2/ CLASS 2	KELAS 3/ CLASS 3	KELAS E/ CLASS E
KEGUNAAN / **USES**	Pemeliharaan, Kawasan Dilindungi, Taman Laut / **Preservation, Marine Protected areas, Marine Parks**	Kehidupan Laut, Perikanan, Terumbu Karang, Rekreasi dan Marikultur / **Marine Life, Fisheries, Coral Reefs, Recreational and Mariculture**	Pelabuhan, Lapangan Minyak dan Gas / **Ports, Oil & Gas Fields**	Paya Bakau & Muara Sungai / **Mangroves Estuarine & River-mouth Water**
Suhu (°C) / Temperature (°C)	≤ 2°C peningkatan terhadap ambien maksimum ≤ 2°C increase over maximum ambient	≤ 2°C peningkatan terhadap ambien maksimum ≤ 2°C increase over maximum ambient	≤ 2°C peningkatan terhadap ambien maksimum ≤ 2°C increase over maximum ambient	≤ 2°C peningkatan terhadap ambien maksimum ≤ 2°C increase over maximum ambient
Oksigen Terlarut (mg/L) / Dissolved Oxygen (mg/L)	>80% tepu >80% saturation	5	3	4
Jumlah Pepejal Terampai* (mg/L) / Total suspended solid (mg/L)	25 mg/L atau ≤ 10% peningkatan dalam purata bermusim, yang mana lebih rendah / 25 mg/L or ≤ 10% increase in seasonal average, whichever is lower	50mg/L (25 mg/L) atau ≤ 10% peningkatan dalam purata bermusim, yang mana lebih rendah / 50mg/L (25 mg/L) or ≤ 10% increase in seasonal average, whichever is lower	100 mg/L atau ≤ 10% peningkatan dalam purata bermusim, yang mana lebih rendah / 100 mg/L or ≤ 10% increase in seasonal average, whichever is lower	100 mg/L atau ≤ 30 % peningkatan dalam purata bermusim, yang mana lebih rendah / 100 mg/L or ≤ 30 % increase in seasonal average, whichever is lower
Minyak dan Geris (mg/L) / Oil and grease (mg/L)	0.01	0.14	5	0.14
Raksa* (µg/L) / Mercury* (µg/L)	0.04	0.16 (0.04)	50	0.5

Jadual 5.2: Standard dan Kriteria Kualiti Air Marin

Table 5.2: Malaysia Marine Water Quality Criteria and Standards

PARAMETER/ PARAMETER	KELAS 1/ CLASS 1	KELAS 2/ CLASS 2	KELAS 3/ CLASS 3	KELAS E/ CLASS E
KEGUNAAN / **USES**	Pemeliharaan, Kawasan Dilindungi, Taman Laut / **Preservation, Marine Protected areas, Marine Parks**	Kehidupan Laut, Perikanan, Terumbu Karang, Rekreasi dan Marikultur / **Marine Life, Fisheries, Coral Reefs, Recreational and Mariculture**	Pelabuhan, Lapangan Minyak dan Gas / **Ports, Oil & Gas Fields**	Paya Bakau & Muara Sungai / **Mangroves Estuarine & River-mouth Water**
Kadmium* (µg/L) / Cadmium* (µg/L)	0.5	2 (3)	10	2
Kromium (VI) (µg/L) / Chromium (VI) (µg/L)	5	10	48	10
Kuprum (µg/L) / Copper (µg/L)	1.3	2.9	10	2.9
Arsenik (III)* (µg/L) / Arsenic (III)* (µg/L)	3	20(3)	50	20 (3)
Plumbum (µg/L) / Lead (µg/L)	4.4	8.5	50	8.5
Zink (µg/L) / Zinc (µg/L)	15	50	100	50
Sianida (µg/L) / Cyanide (µg/L)	2	7	20	7
Ammonia (tidak terion) (µg/L) / Ammonia (unionized) (µg/L)	35	70	320	70
Nitrit (NO_2) (µg/L) / Nitrite (NO_2) (µg/L)	10	55	1,000	55
Nitrat (NO_3) (µg/L) / Nitrate (NO_3) (µg/L)	10	60	1,000	60

Jadual 5.2: Standard dan Kriteria Kualiti Air Marin

Table 5.2: Malaysia Marine Water Quality Criteria and Standards

PARAMETER/ PARAMETER	KELAS 1/ CLASS 1	KELAS 2/ CLASS 2	KELAS 3/ CLASS 3	KELAS E/ CLASS E
KEGUNAAN / **USES**	Pemeliharaan, Kawasan Dilindungi, Taman Laut / **Preservation, Marine Protected areas, Marine Parks**	Kehidupan Laut, Perikanan, Terumbu Karang, Rekreasi dan Marikultur / **Marine Life, Fisheries, Coral Reefs, Recreational and Mariculture**	Pelabuhan, Lapangan Minyak dan Gas / **Ports, Oil & Gas Fields**	Paya Bakau & Muara Sungai / **Mangroves Estuarine & River-mouth Water**
Fosfat (µg/L) / Phosphate (µg/L)	5	75	670	75
Fenol (µg/L) / 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

*Nota: * Nilai SKKAM dalam kurungan digunakan untuk kawasan air marin yang menjadi sumber makanan laut*
*Note: * MWQCS in parentheses are for coastal and marine water areas where seafood for human consumption is applicable*

Jadual 5.2: Standard dan Kriteria Kualiti Air Marin

Table 5.2: Malaysia Marine Water Quality Criteria and Standards

STATUS KUALITI AIR MARIN PANTAI

Dalam tahun 2013, sebanyak 155 stesen pantai telah dipantau, dianalisa serta dilaporkan dalam Indeks Kualiti Air Marin. Hasil pengawasan menunjukkan empat(4) stesen (2.6%) dikategorikan sebagai Terbaik, 15 stesen (9.7%) sebagai Baik, 125 stesen (80.6%) sebagai Sederhana dan 11 stesen (7.1%) sebagai Tercemar. **(Jadual 5.3).**

COASTAL WATER QUALITY STATUS

In 2013, a total of 155 coastal stations were monitored, analyzed and reported according to the Marine Water Quality Index. The results indicate four(4) stations (2.6%) as Excellent, 15 stations (9.7%) as Good, 125 stations (80.6%) as Moderate and 11 stations (7.1%) as Poor **(Table 5.3).**

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Kedah	Pantai / Coastal	Pantai Merdeka	5603905	71.62	71.62	59.92	Sederhana / Moderate
		Langkawi Island Resort	6399914	73.60	73.60	60.61	Sederhana / Moderate
		Pantai Kok	6397922	60.45	60.45	69.04	Sederhana / Moderate
		Pantai Kuah	6398925	74.13	74.13	62.02	Sederhana / Moderate
		Pantai Pasir Tengkorak	6499701	72.87	72.87	84.28	Baik / Good
		Pantai Teluk Burau	6396923	56.11	56.11	81.59	Baik / Good
		Pantai Teluk Nibong	6497915	54.93	54.93	74.92	Sederhana / Moderate
		Pantai Tengah	6297903	-	-	69.04	Sederhana / Moderate
Pulau Pinang	Pantai / Coastal	Gertak Sanggul	5201919	82.18	58.29	56.60	Sederhana / Moderate
		Kawasan Perindustrian Bayan Lepas I	5303932	62.54	61.00	50.26	Sederhana / Moderate
		Kawasan Perindustrian Bayan Lepas II	5303933	63.09	62.33	51.17	Sederhana / Moderate
		Kawasan Perindustrian Bayan Lepas III	5302939	58.78	55.65	49.12	Tercemar/ Poor
		Pantai Bersih	5403906	72.19	52.38	61.81	Sederhana / Moderate
		Pantai Miami	5502901	83.37	65.52	50.22	Sederhana / Moderate
		Pantai Pasir Panjang	5201938	74.15	63.02	58.66	Sederhana / Moderate
		Batu Feringgi	5402904	61.16	81.13	53.81	Sederhana / Moderate

Jadual 5.3 Malaysia: Status Kualiti Air Marin Kawasan Pantai

Table 5.3 Malaysia: Coastal Marine Water Quality Status

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Pulau Pinang	Pantai / Coastal	Luar Pantai Teluk Bahang	5402930	84.28	68.52	74.79	Sederhana / Moderate
		Persiaran Gurney	5403902	61.85	68.05	51.75	Sederhana / Moderate
		Rumah Pam Baru Perai	5304927	64.92	50.48	50.53	Sederhana / Moderate
		Rumah Pam Lama Perai	5303926	66.63	61.60	51.02	Sederhana / Moderate
		Selat PP Selatan (Jelutong)	5303911	61.49	58.13	60.52	Sederhana / Moderate
		Tanjung Bungah	5402937	61.61	51.98	51.91	Sederhana / Moderate
		Teluk Tempoyak	5202923	74.03	77.99	57.00	Sederhana / Moderate
		Batu Maung	5202901	-	-	72.34	Sederhana / Moderate
Perak	Pantai / Coastal	Pantai Pasir Bogak	4205908	62.23	55.69	51.75	Sederhana / Moderate
		Pantai Teluk Dalam	4205928	87.90	39.94	65.64	Sederhana / Moderate
		Pantai Teluk Batik	4205932	88.55	60.35	63.86	Sederhana / Moderate
		Pantai Tanjung Batu	4406927	40.32	40.32	56.32	Sederhana / Moderate
		Pantai Pasir Panjang	4205924	63.16	63.16	64.09	Sederhana / Moderate
Selangor	Pantai / Coastal	Pantai Bagan Lalang	2616927	63.51	90.57	86.08	Baik / Good
		Pantai Morib	2712902	52.18	75.03	53.76	Sederhana / Moderate
		Selat Pulau Babi	3012929	63.47	90.98	65.21	Sederhana / Moderate
		Selat Klang Utara	3013908	65.82	89.14	64.28	Sederhana / Moderate
Negeri Sembilan	Pantai / Coastal	Bagan Pinang	2518915	72.47	72.47	67.90	Sederhana / Moderate
		Telok Sinting	2419908	65.90	65.90	72.29	Sederhana / Moderate
		Port Dickson Bandar	2517907	66.45	66.45	75.97	Sederhana / Moderate
		Port Dickson Batu 4	2518937	-	-	68.60	Sederhana / Moderate
		Port Dickson Batu 5	2418906	81.60	81.60	68.41	Sederhana / Moderate
		Port Dickson Batu 6	2418916	89.61	89.61	73.31	Sederhana / Moderate
		Port Dickson Batu 7	2418905	64.49	64.49	71.36	Sederhana / Moderate
		Port Dickson Batu 8	2418912	75.72	75.72	94.06	Terbaik / Excellent
		Port Dickson Batu 10	2418914	66.34	66.34	94.40	Terbaik / Excellent

Jadual 5.3 Malaysia: Status Kualiti Air Marin Kawasan Pantai

Table 5.3 Malaysia: Coastal Marine Water Quality Status

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Negeri Sembilan	Pantai / Coastal	Port Dickson Janakuasa TNB	2517909	66.19	66.19	74.92	Sederhana / Moderate
		Telok Pelanduk	2419917	80.93	80.93	91.62	Terbaik/ Excellent
		Pantai Cermin	2416918	89.19	89.19	92.36	Terbaik/ Excellent
Melaka	Pantai / Coastal	Teluk Gong	2320902	55.02	79.24	45.18	Tercemar/ Poor
		Pulau Melaka Point A(i)	2121915	43.76	50.24	42.39	Tercemar/ Poor
		Pulau Melaka Point A(ii)	2121915	49.15	49.15	40.67	Tercemar/ Poor
		Pulau Melaka Point B(i)	2121916	48.08	48.31	41.95	Tercemar/ Poor
		Pulau Melaka Point B(ii)	2121916	49.61	49.61	42.32	Tercemar/ Poor
Johor	Pantai / Coastal	Tanjung Bin	1336975	87.65	88.98	88.26	Baik / Good
		Pelabuhan Tanjung Pelepas	1438943	88.09	86.35	85.67	Baik / Good
		Hadapan Jabatan Laut	1438918	54.77	66.86	78.90	Sederhana / Moderate
		Pantai Stulang Laut	1437951	70.74	61.36	61.19	Sederhana / Moderate
		Jeti Teluk Jawa	1438918	64.70	62.37	65.03	Sederhana / Moderate
		Pelabuhan Pasir Gudang	1428939	66.24	61.48	63.94	Sederhana / Moderate
		Hadapan HSAJB	1437920	66.66	54.37	63.48	Sederhana / Moderate
		Pantai Lido	1437921	67.01	55.94	64.32	Sederhana / Moderate
		Pantai Teluk Mahkota	1841911	80.46	78.57	82.96	Baik / Good
		Pantai Tanjung Leman	2140694	82.79	78.72	83.06	Baik / Good
		Pantai Sri Pantai	2339960	80.26	80.02	59.57	Sederhana / Moderate
		Tanjung Merak	1441968	81.54	82.82	49.56	Baik / Good
		Tanjung Pengelih	1441967	82.93	83.31	76.20	Baik / Good
		Pantai Tanjong Stapa	1341961	78.24	81.10	57.47	Sederhana / Moderate
		Pantai Teluk Gorek	2538958	-	84.07	60.72	Sederhana / Moderate
		Pantai Air Papan	2538959	87.02	82.50	79.08	Sederhana / Moderate
		Jeti Kukup	1334925	62.69	86.43	58.52	Sederhana / Moderate
		Jeti Tanjong Belungkor	1440963	80.14	84.21	80.31	Baik / Good

Jadual 5.3 Malaysia: Status Kualiti Air Marin Kawasan Pantai

Table 5.3 Malaysia: Coastal Marine Water Quality Status

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Johor	Pantai / Coastal	Pasir Gogok	1441966	69.26	83.94	71.97	Sederhana / Moderate
		Tanjung Buai	1340973	86.44	84.61	60.45	Sederhana / Moderate
		Pantai Desaru	1542914	92.51	85.33	82.91	Baik / Good
		Tanjung Sepang	1443969	90.82	84.86	81.78	Baik / Good
		Tanjung Penyusup	1444920	89.52	82.21	82.02	Baik / Good
		Pantai Sungai Lurus	1730962	52.07	81.76	64.81	Sederhana / Moderate
		Punggur	1531974	52.45	68.18	49.47	Tercemar / Poor
Pahang	Pantai / Coastal	Pantai Cherating (Club Med)	4133903 (A)	79.44	70.48	73.92	Sederhana / Moderate
		Pantai Cherating (Club Med)	4133903 (B)	70.48	70.48	73.83	Sederhana / Moderate
		Pantai Cherating (Legend)	4133942 (A)	75.73	70.02	73.76	Sederhana / Moderate
		Pantai Cherating (Legend)	4133942 (B)	70.87	70.87	73.96	Sederhana / Moderate
		Pantai Muhibbah Balok	3933901 (A)	52.06	51.16	72.82	Sederhana / Moderate
		Pantai Muhibbah Balok	3933901 (B)	51.04	51.04	71.03	Sederhana / Moderate
		Pantai Batu Hitam	3833915 (A)	71.20	69.36	73.09	Sederhana / Moderate
		Pantai Batu Hitam	3833915 (B)	71.08	71.08	73.87	Sederhana / Moderate
		Pantai Berserah	3933941 (A)	67.48	70.90	73.62	Sederhana / Moderate
		Pantai Berserah	3933941 (B)	55.11	55.11	73.84	Sederhana / Moderate
		Pantai Teluk Cempedak	3833910 (A)	67.99	64.29	73.96	Sederhana / Moderate
		Pantai Teluk Cempedak	3833910 (B)	46.56	46.56	73.89	Sederhana / Moderate
		Pantai Teluk Gelora	3833909 (A)	52.24	50.21	55.80	Sederhana / Moderate
		Pantai Teluk Gelora	3833909 (B)	50.49	50.49	61.48	Sederhana / Moderate
		Pantai Sepat	3737915	75.78	70.11	73.52	Sederhana / Moderate
		Pantai Sepat (B)	3633916	73.78	73.64	73.89	Sederhana / Moderate
		Pantai Legenda (A)	3534943 (A)	64.74	70.92	73.62	Sederhana / Moderate
		Pantai Legenda (B)	3534943 (B)	70.44	70.97	73.62	Sederhana / Moderate

Jadual 5.3 Malaysia: Status Kualiti Air Marin Kawasan Pantai

Table 5.3 Malaysia: Coastal Marine Water Quality Status

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Pahang	Pantai / Coastal	Pantai Kuala Api-Api	3235917	68.19	70.71	72.90	Sederhana / Moderate
		Pantai Tanjung Batu	3334915	58.64	70.50	72.65	Sederhana / Moderate
		Pantai Batu Buruk	5331935	53.47	57.66	66.87	Sederhana / Moderate
		Pantai Bukit Keluang	5825903	76.96	70.00	63.44	Sederhana / Moderate
		Pantai Chendering	5231934	57.99	51.76	66.03	Sederhana / Moderate
		Pantai Rantau Abang	4833917	85.50	70.11	68.06	Sederhana / Moderate
		KIPC Utara	4634954	83.71	50.19	65.02	Sederhana / Moderate
		KIPC Tengah	4534955	86.08	63.65	64.23	Sederhana / Moderate
		KIPC Selatan	4534956	83.63	51.70	69.81	Sederhana / Moderate
Kelantan	Pantai / Coastal	Pantai Seri Tujuh	6221910	65.76	65.76	66.22	Sederhana / Moderate
		Pantai Cahaya Bulan	6122903	61.83	61.83	66.00	Sederhana / Moderate
		Pantai Sabak	6123909	63.46	63.46	58.87	Sederhana / Moderate
		Pantai Irama Bachok	6024908	70.50	70.50	56.77	Sederhana / Moderate
		Pantai Bisikan Bayu	5825905	62.00	62.00	50.28	Sederhana / Moderate
Sarawak	Pantai / Coastal	Pantai Sematan	1898902	82.78	67.79	59.58	Sederhana / Moderate
		Pantai Pandan	1824918	85.21	60.43	57.94	Sederhana / Moderate
		Pantai Pasir Putih	1604910	70.33	69.60	44.04	Tercemar / Poor
		Pantai Bako	1704906	78.38	73.63	69.65	Sederhana / Moderate
		Pantai Damai	1702904	73.06	70.20	58.34	Sederhana / Moderate
		Pantai Tanjung Kembang	1810923	69.44	70.40	69.32	Sederhana / Moderate
		Pantai Harmoni Mukah	2920921	50.30	69.90	53.42	Sederhana / Moderate
		Pantai Tanjung Batu	3132602	34.98	34.98	62.49	Sederhana / Moderate
		Pantai Likau	3230915	48.22	48.22	51.99	Sederhana / Moderate
		Pantai Emas	3331903	34.98	34.98	63.45	Sederhana / Moderate
		Pantai Piasau	4539918	66.78	66.78	54.53	Sederhana / Moderate
		Pantai Brighton	4449917	57.31	52.45	54.84	Sederhana / Moderate
		Pantai Esplaned	4339920	53.47	53.47	54.97	Sederhana / Moderate

Jadual 5.3 Malaysia: Status Kualiti Air Marin Kawasan Pantai
Table 5.3 Malaysia: Coastal Marine Water Quality Status

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Sarawak	Pantai / Coastal	Pantai Beraya	4238921	72.00	72.00	70.12	Sederhana / Moderate
		Pantai Bungai	4137922	72.35	72.35	53.41	Sederhana / Moderate
		Pantai Belawai	2212913	54.17	52.44	76.91	Sederhana / Moderate
Sabah	Pantai / Coastal	Pantai Teluk Brunei 1	5053901	72.36	72.36	71.27	Sederhana / Moderate
		Pantai Teluk Brunei 2	5053902	64.45	64.45	70.87	Sederhana / Moderate
		Pantai Teluk Brunei 3	5053903	72.96	72.95	69.26	Sederhana / Moderate
		Pantai Teluk Brunei 4	5053904	73.71	73.71	73.17	Sederhana / Moderate
		Pantai Teluk Brunei 5	5053905	75.38	75.38	73.94	Sederhana / Moderate
		Pantai Teluk Brunei 6	5053906	66.58	66.58	74.56	Sederhana / Moderate
		Borneo Golf Seawater	5355901	73.39	73.39	79.01	Sederhana / Moderate
		Pantai Manis Papar	5555901	85.29	85.29	81.64	Baik / Good
		Pantai Melinsung	5565902	84.09	84.09	78.52	Sederhana / Moderate
		Pantai Tanjung Aru (Rest Lido)	5656901	78.28	78.28	77.54	Sederhana / Moderate
		Pantai Tanjung Aru (Roll Skating)	5656902	74.49	74.49	76.46	Sederhana / Moderate
		Pantai Tanjung Aru (No. 3)	5656903	69.93	69.93	65.33	Sederhana / Moderate
		Pantai Lok Kawi	5656904	64.61	64.61	67.48	Sederhana / Moderate
		Pantai Dalit Tuaran	6161901	86.22	86.22	70.89	Sederhana / Moderate
		Mangrove Paradise	6161902	68.82	68.82	77.51	Sederhana / Moderate
		Pantai Sabandar	6161903	80.54	80.54	72.57	Sederhana / Moderate
		Pantai Bak-Bak Kudat	6665901	89.28	89.28	81.06	Baik / Good
		Pasir Putih Sandakan	5580901	85.12	85.12	73.89	Sederhana / Moderate
		Pantai TLDM	5580902	56.26	56.26	75.20	Sederhana / Moderate
		Pantai Batu Sapi	5580903	89.99	89.99	74.90	Sederhana / Moderate
		Pantai Ulu Tungku	5085901	88.17	88.17	72.82	Sederhana / Moderate
		Pantai Sarina Kunak	4481901	89.32	89.32	72.77	Sederhana / Moderate

Jadual 5.3 Malaysia: Status Kualiti Air Marin Kawasan Pantai

Table 5.3 Malaysia: Marine Water Quality Status for Coastal

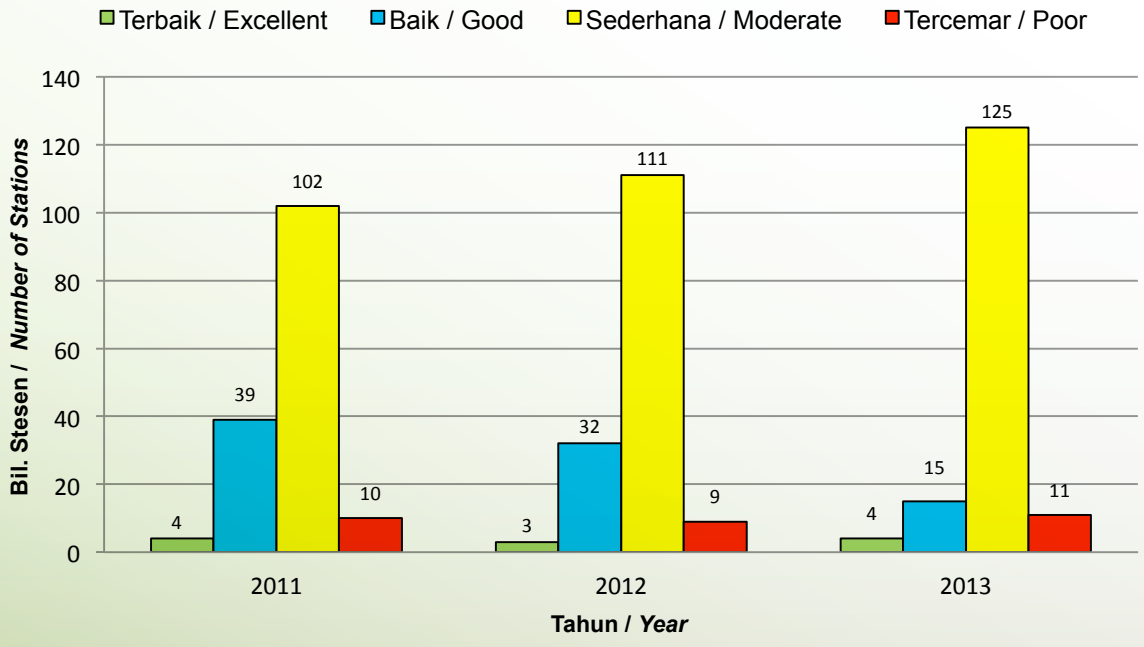
NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Sabah	Pantai / Coastal	Pantai Kg. Lamak	4581902	89.01	89.01	71.67	Sederhana / Moderate
		Pantai Tinagat	4473901	91.28	91.28	74.51	Sederhana / Moderate
Labuan	Pantai / Coastal	Pulau Papan	5151905	49.12	65.11	65.92	Sederhana / Moderate
		Kiamsam	5151906	62.67	66.37	61.69	Sederhana / Moderate
		Sungai Pagar	5151907	48.21	66.10	63.05	Sederhana / Moderate
		Layang-Layangan	5251902	55.39	68.15	62.22	Sederhana / Moderate
		Tanjung Aru	5251903	61.99	65.93	66.59	Sederhana / Moderate

Jadual 5.3 Malaysia: Status Kualiti Air Marin Kawasan Pantai

Table 5.3 Malaysia: Coastal Marine Water Quality Status

Tren Indeks Kualiti Air Marin (IKAM) mulai tahun 2011 hingga 2013 adalah seperti yang ditunjuk dalam **Rajah 5.1**.Bilangan stesen terbaik, sederhana dan tercemar menunjukkan peningkatan, manakala bagi

The trend in terms of Marine Water Quality Index (MWQI) from 2011 to 2013 is as shown in **Figure 5.1**. The number of excellent, moderate and poor water quality stations had increased, while the number of good stations had decreased.



Rajah 5.1 Malaysia: Tren Status Kualiti Air Marin Kawasan Pantai Di Malaysia, 2011-2013

Figure 5.1 Malaysia: The trend of Marine Water Status for Coastal Area in Malaysia, 2011-2013

STATUS KUALITI AIR KUALA

Dalam tahun 2013, sebanyak 76 stesen Kuala telah dipantau dan dianalisa serta dilaporkan sebagai Indeks Kualiti Air Marin. Hasil program pengawasan yang telah dilakukan menunjukkan satu (1) stesen (1.3%) dikategorikan sebagai terbaik, 7 stesen (9.2%) sebagai baik, 54 stesen (71.1%) sebagai sederhana dan 14 stesen (18.4%) sebagai tercemar **(Jadual 5.4)**

ESTUARY WATER QUALITY STATUS

In 2013, 76 estuary stations were monitored, analysed and reported as Marine Water Quality Index. The result from the monitoring programme indicated that one (1) station (1.3%) as excellent, 7 stations (9.2%) as good, 54 stations (71.1%) as moderate and 14 stations (18.4%) as poor. **(Table 5.4)**

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Perlis	Kuala / Estuary	Kuala Sungai Baru	6201902	52.61	52.61	55.87	Sederhana / Moderate
		Kuala Sungai Perlis	6401901	54.66	54.66	48.76	Tercemar / Poor
Kedah	Kuala / Estuary	Kuala Kedah	6102908	65.38	65.38	84.21	Baik / Good
		Kuala Jerlun	6302925	65.38	65.38	74.29	Sederhana / Moderate
Pulau Pinang	Kuala / Estuary	Kuala Sungai Jawi	5204901	57.37	61.04	50.49	Sederhana / Moderate
		Kuala Sungai Juru	5303904	49.58	60.11	49.72	Tercemar / Poor
		Kuala Sungai Kerian	5104901	64.38	60.42	80.43	Baik / Good
		Kuala Sungai Pinang	5403934	62.90	60.49	50.97	Sederhana / Moderate
		Kuala Sungai Perai	5303908	49.39	55.11	61.88	Sederhana / Moderate
		Kuala Sungai Tengah	5204935	61.08	81.36	63.34	Sederhana / Moderate
		Kuala Sungai Pinang (Balik Pulau)	5202929	50.43	48.51	37.63	Tercemar / Poor
Perak	Kuala / Estuary	Kuala Sungai Manjung	4205930	89.28	33.36	60.32	Sederhana / Moderate
		Kuala Sungai Gula	4906926	22.92	35.12	50.92	Sederhana / Moderate
		Kuala Sungai Kurau	4994919	41.58	41.58	67.63	Sederhana / Moderate
		Kuala Sungai Tanjung Piandang	5003921	38.67	38.67	52.25	Sederhana / Moderate
		Kuala Sungai Sepetang	4806925	23.35	23.55	32.33	Tercemar / Poor
		Kuala Sungai Perak	4007901	66.49	46.34	66.08	Sederhana / Moderate
Selangor	Kuala / Estuary	Kuala Sungai Sepang	2517922	81.79	87.09	88.35	Baik / Good
		Kuala Sungai Sepang (Kecil)	2612928	63.92	90.46	89.61	Baik / Good
		Kuala Sungai Sepang (Kawalan)	2616926	61.62	89.35	72.81	Sederhana / Moderate
		Kuala Sungai Langat (Jugra)	2814925	53.02	73.81	53.62	Sederhana / Moderate
		Kuala Sungai Klang	3013909	55.23	75.12	50.83	Sederhana / Moderate
		Kuala Sungai Langat (Lumut)	2913903	63.87	75.03	61.85	Sederhana / Moderate
		Kuala Sungai Buloh	3212930	66.52	74.69	53.82	Sederhana / Moderate
		Kuala Sungai Selangor	3312915	66.57	87.24	51.01	Sederhana / Moderate

Jadual 5.4 Malaysia: Status Kualiti Air Marin Di Kawasan Kuala

Table 5.4 Malaysia: Marine Water Quality Status for Estuary

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Selangor	Kuala / Estuary	Kuala Sungai Tengi	3311931	52.21	74.03	47.95	Tercemar / Poor
		Kuala Sungai Bernam	3808924	66.32	88.52	70.11	Sederhana / Moderate
Negeri Sembilan	Kuala / Estuary	Kuala Sungai Linggi	2319901	64.27	64.27	75.46	Sederhana / Moderate
		Kuala Sungai Lukut	2517910	67.94	67.94	66.78	Sederhana / Moderate
Melaka	Kuala / Estuary	Kuala Sungai Melaka	2123903	49.89	56.78	35.12	Tercemar / Poor
		Kuala Sungai Sri Melaka	2121914	48.65	56.51	34.00	Tercemar / Poor
		Kuala Sungai Merlimau	2124912	64.06	47.57	35.41	Tercemar / Poor
		Kuala Sungai Kesang	2186905	67.08	61.71	45.29	Tercemar / Poor
		Kuala Sungai Sebatu	2186904	62.82	54.16	45.37	Tercemar / Poor
Johor	Kuala / Estuary	Kuala Sungai Segget	1437919	67.50	57.21	61.50	Sederhana / Moderate
		Kuala Sungai Skudai	1437922	68.16	61.32	60.73	Sederhana / Moderate
		Kuala Sungai Melayu	1437946	67.84	63.94	63.73	Sederhana / Moderate
		Kuala Sungai Tebrau	1438943	67.64	61.54	59.46	Sederhana / Moderate
		Kuala Sungai Kim-Kim	1439965	83.54	60.34	66.47	Sederhana / Moderate
		Kuala Sungai Johor	1440916	91.60	59.45	83.38	Baik / Good
		Kuala Sungai Batu Pahat	1729930	62.99	82.33	59.89	Sederhana / Moderate
		Kuala Sungai Muar	2024932	62.63	82.37	49.41	Tercemar / Poor
		Kuala Sungai Mersing	2438905	67.41	82.88	75.62	Sederhana / Moderate
Terengganu	Kuala / Estuary	Kuala Sungai Besut	5825902	61.13	61.22	61.30	Sederhana / Moderate
		Kuala Sungai Dungun	4734918	53.15	51.70	49.72	Tercemar / Poor
		Kuala Sungai Ibai	5231949	53.31	52.08	51.26	Sederhana / Moderate
		Kuala Sungai Kerteh	4534922	74.31	57.50	52.34	Sederhana / Moderate
		Kuala Sungai Marang	5232911	71.49	57.59	70.04	Sederhana / Moderate
		Kuala Sungai Paka	4634920	80.99	62.71	59.15	Sederhana / Moderate
		Kuala Sungai Setiu	5627953	49.83	56.41	61.10	Sederhana / Moderate

Jadual 5.4 Malaysia: Status Kualiti Air Marin Di Kawasan Kuala

Table 5.4 Malaysia: Marine Water Quality Status for Estuary

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Terengganu	Kuala / Estuary	Kuala Sungai Terengganu	5331907	58.42	51.06	63.64	Sederhana / Moderate
		Kuala Sungai Kemaman / Chukai	4234929	82.32	49.76	49.06	Tercemar / Poor
		Tioxide Utara (Kg. Bukit Kuang, Kijal)	4234950	86.37	70.52	64.84	Sederhana / Moderate
		Tioxide Tengah (Pupuk Semangat, Kijal)	4234951	88.57	70.32	66.61	Sederhana / Moderate
		Tioxide Selatan (KSB, T. Kalong)	4234952	88.02	69.60	66.52	Sederhana / Moderate
		Pulau Duyung	5231908	65.29	50.15	64.80	Sederhana / Moderate
Kelantan	Kuala / Estuary	Kuala Sungai Golok	6220911	56.01	56.01	64.02	Sederhana / Moderate
		Kuala Sungai Kelantan	6222901	45.08	45.08	53.90	Sederhana / Moderate
		Kuala Sungai Pengkalan Chepa	6223912	48.16	48.16	54.67	Sederhana / Moderate
		Kuala Sungai Pengkalan Datu	6123913	59.05	59.05	51.07	Sederhana / Moderate
		Kuala Sungai Kemasin	5824914	59.36	59.36	50.90	Sederhana / Moderate
Sarawak	Kuala / Estuary	Kuala Sungai Semantan	1898901	79.45	72.01	55.06	Sederhana / Moderate
		Kuala Sungai Sarawak	1604907	61.59	67.11	51.47	Sederhana / Moderate
		Kuala Sungai Bako	1704905	59.67	55.69	53.91	Sederhana / Moderate
		Kuala Sungai Santubong	1702903	86.81	70.00	66.57	Sederhana / Moderate
		Kuala Batang Krian (Kabong)	1710922	70.39	70.39	53.09	Sederhana / Moderate
		Kuala Batang Rejang	2111909	70.81	70.81	86.75	Baik / Good
		Kuala Mukah	2920920	59.31	59.31	34.57	Tercemar / Poor
		Kuala Batang Kemena	3130911	56.56	56.56	63.94	Sederhana / Moderate
		Kuala Tanjung Similajau	3431903	41.75	41.75	63.98	Sederhana / Moderate
		Kuala Sungai Panipah	3332904	-	-	88.78	Baik / Good
		Kuala Pantai Nyalau	3431903	-	-	90.10	Terbaik / Excellent
		Kuala Sungai Baram	4539919	-	-	64.13	Sederhana / Moderate
		Kuala Sungai Miri	4349915	-	-	64.63	Sederhana / Moderate

Jadual 5.4 Malaysia: Status Kualiti Air Marin Di Kawasan Kuala

Table 5.4 Malaysia: Marine Water Quality Status for Estuary

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Sabah	Kuala / Estuary	Kuala Penyu	5453901	55.42	55.42	77.68	Sederhana / Moderate
		Muara Sungai Inanam	5050905	58.76	58.76	59.15	Sederhana / Moderate

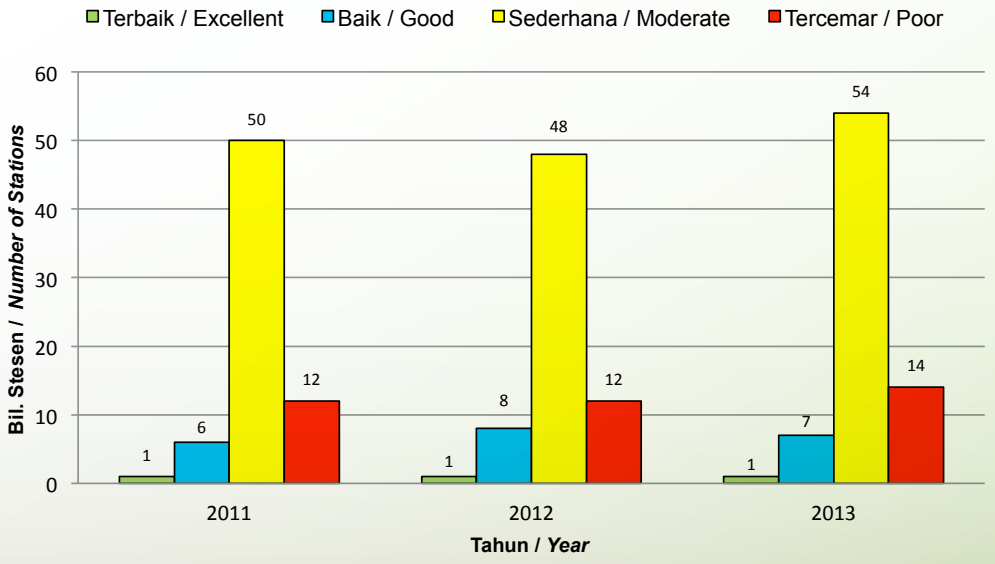
Jadual 5.4 Malaysia: Status Kualiti Air Marin Di Kawasan Kuala

Table 5.4 Malaysia: Marine Water Quality Status for Estuary

stesen baik menunjukkan penurunan.

Dalam tahun 2013, berdasarkan Indeks Kualiti Air Marin (IKAM), kualiti air di kawasan kuala menunjukkan sedikit peningkatan bagi kategori sederhana iaitu daripada 69.6% (2012) kepada 71.1% bagi tahun 2013. Bilangan stesen tercemar juga meningkat daripada 12 stesen dalam tahun 2012 kepada 14 stesen bagi tahun 2013. Bagi kategori stesen baik,terdapat penurunan daripada lapan (8) stesen pada tahun 2012 kepada tujuh (7) stesen pada tahun 2013. Bagi kategori stesen terbaik, bilangan stesen kekal sama iaitu satu (1) stesen bagi tahun 2012 dan 2013. Tren ini ditunjukkan dalam **Rajah 5.2.**

The quality of estuarine water in terms of Marine Water Quality Index (MWQI), showed a slight increase in the moderate category from 69.6% in 2012 to 71.1% in 2013. The stations with poor quality increased from 12 in 2012 to 14 in 2013. There was a decline from eight (8) in 2012 to seven (7) in 2013 for stations in the good category. Meanwhile, for the excellent category, the figures remained unchanged in 2013 as compared to 2012. These trends are tabulated in **Figure 5.2.**



Rajah 5.2 Malaysia: Tren Status Kualiti Air Marin Bagi Kawasan Kuala, 2011-2013

Figure 5.2 Malaysia: The Trend Of Marine Water Quality Status for Estuary, 2011-2013

STATUS KUALITI AIR MARIN PULAU

Senarai stesen Pulau berdasarkan kategori stesen seperti yang ditunjukkan dalam **Jadual 5.5.**

ISLAND MARINE WATER QUALITY STATUS

The list of island stations by island category is as shown in **Table 5.5.**

NEGERI STATE	BIL. PULAU NO. OF ISLAND	BIL. STESEN NO. OF STATION	PULAU ISLAND	NO. STESEN STATION NO	KATEGORI CATEGORY
KEDAH	7	4	LANGKAWI (PANTAI KUAH)	7KD07	PEMBANGUNAN / DEVELOPMENT
			LANGKAWI (TELUK EWA)	7KD08	PEMBANGUNAN / DEVELOPMENT
			LANGKAWI (PANTAI CHENANG)	7KD09	PEMBANGUNAN / DEVELOPMENT
			LANGKAWI (TANJUNG RHU)	7KD10	PEMBANGUNAN / DEVELOPMENT
		1	SINGA BESAR	7KR01	PERANGINAN / RESORT
		1	DAYANG BUNTING	7KR02	PERANGINAN / RESORT
		1	PAYAR	7KM03	TAMAN LAUT / MARINE PARK
		1	KACA	7KM04	TAMAN LAUT / MARINE PARK
		1	LEMBU	7KM05	TAMAN LAUT / MARINE PARK
		1	SIGANTANG	7KM06	TAMAN LAUT / MARINE PARK
PULAU PINANG	6	3	PULAU PINANG (BATU MAUNG)	7PD01	PEMBANGUNAN / DEVELOPMENT
			PULAU PINANG (TELUK BAHANG)	7PD03	PEMBANGUNAN / DEVELOPMENT
			PULAU PINANG (PADANG KOTA)	7PD04	PEMBANGUNAN / DEVELOPMENT
		1	AMAN	7PR05	PERANGINAN / RESORT
		1	JEREJAK	7PR06	PERANGINAN / RESORT
		1	KENDI	7PR07	PERANGINAN / RESORT

Jadual 5.5 Malaysia: Stesen-Stesen Pulau, 2013

Table 5.5 Malaysia: Island Stations , 2013

NEGERI STATE	BIL. PULAU NO. OF ISLAND	BIL. STESEN NO. OF STATION	PULAU ISLAND	NO. STESEN STATION NO	KATEGORI CATEGORY
		1	RIMAU	7PR08	PERANGINAN / RESORT
		1	GEDONG	7PR09	PERANGINAN / RESORT
PERAK	4	2	PANGKOR (TELOK GEDONG)	7AR01	PERANGINAN / RESORT
			PANGKOR (PANTAI PUTERI DEWI)	7AR02	PERANGINAN / RESORT
		1	PANGKOR LAUT	7AR03	PERANGINAN / RESORT
		1	SEMBILAN	7AR04	PERANGINAN / RESORT
		1	TUKUN PERAK	7AP05	DILINDUNGI / PROTECTED
SELANGOR	3	1	KETAM	7BR01	PERANGINAN / RESORT
		1	ANGSA	7BR02	PERANGINAN / RESORT
		1	LUMUT	7BR03	PERANGINAN / RESORT
NEGERI SEMBILAN	1	1	ARANG	7NP01	DILINDUNGI / PROTECTED
MELAKA	3	2	BESAR (A)	7MR01	PERANGINAN / RESORT
			BESAR (B)	7MR01	PERANGINAN / RESORT
		2	UPEH (A)	7MR02	PERANGINAN / RESORT
			UPEH (B)	7MR02	PERANGINAN / RESORT
		2	UNDAN (A)	7MR03	PERANGINAN / RESORT
			UNDAN (B)	7MR03	PERANGINAN / RESORT
JOHOR	3	1	SETINDAN	7JR01	PERANGINAN / RESORT
		1	BABI TENGAH	7JR02	PERANGINAN / RESORT
		1	DAYANG	7JM03	TAMAN LAUT / MARINE PARK

Jadual 5.5 Malaysia: Stesen-Stesen Pulau, 2013

Table 5.5 Malaysia: Island Stations , 2013

NEGERI STATE	BIL. PULAU NO. OF ISLAND	BIL. STESEN NO. OF STATION	PULAU ISLAND	NO. STESEN STATION NO	KATEGORI CATEGORY
JOHOR	5	1	NANGA BESAR	7JM08	TAMAN LAUT / MARINE PARK
		1	SIBU TENGAH	7JM11	TAMAN LAUT / MARINE PARK
		1	PEMANGGIL	7JM15	TAMAN LAUT / MARINE PARK
		1	KUKUP	7JP17	DILINDUNGI / PROTECTED
		1	PISANG	7JP18	DILINDUNGI / PROTECTED
PAHANG	8	2	TIOMAN (KG. NIPAH)	7CM01	TAMAN LAUT / MARINE PARK
			TIOMAN (TELOK SALANG)	7CM02	TAMAN LAUT / MARINE PARK
		1	SERI BUAT	7CM03	TAMAN LAUT / MARINE PARK
		1	CEBEH	7CM04	TAMAN LAUT / MARINE PARK
		1	TULAI	7CM05	TAMAN LAUT / MARINE PARK
		1	SEPUI	7CM06	TAMAN LAUT / MARINE PARK
		1	LABAS	7CM07	TAMAN LAUT / MARINE PARK
		1	SEMBILANG	7CM08	TAMAN LAUT / MARINE PARK
		1	TOKONG BAHARA	7CM09	TAMAN LAUT / MARINE PARK
TERENGGANU	3	2	PERHENTIAN BESAR (SOUTH)	7TM04	TAMAN LAUT / MARINE PARK
			PERHENTIAN BESAR (WEST)	7TM05	TAMAN LAUT / MARINE PARK
		1	PERHENTIAN KECIL	7TM06	TAMAN LAUT / MARINE PARK
		2	REDANG (NORTH)	7TM07	TAMAN LAUT / MARINE PARK
			REDANG (SOUTH)	7TM08	TAMAN LAUT / MARINE PARK

Jadual 5.5 Malaysia: Stesen-Stesen Pulau, 2013

Table 5.5 Malaysia: Island Stations , 2013

NEGERI STATE	BIL. PULAU NO. OF ISLAND	BIL. STESEN NO. OF STATION	PULAU ISLAND	NO. STESEN STATION NO	KATEGORI CATEGORY
TERENGGANU	6	1	KAPAS	7TM09	TAMAN LAUT / MARINE PARK
		1	LANG TENGAH	7TM11	TAMAN LAUT / MARINE PARK
		1	PINANG	7TM12	TAMAN LAUT / MARINE PARK
		1	EKOR TEBU	7TM13	TAMAN LAUT / MARINE PARK
		1	LIMA	7TM14	TAMAN LAUT / MARINE PARK
		1	GUMIA	7TR01	PERANGINAN / RESORT
KELANTAN	2	1	PANJANG	7DP01	DILINDUNGI / PROTECTED
		1	KUNDUR	7DP02	DILINDUNGI / PROTECTED
SARAWAK	3	1	SATANG	7QP01	DILINDUNGI / PROTECTED
		1	TALANG-TALANG KECIL	7QP02	DILINDUNGI / PROTECTED
		1	TALANG-TALANG BESAR	7QP03	DILINDUNGI / PROTECTED
SABAH	5	1	GAYA	7SR01	PERANGINAN / RESORT
		1	MABUL	7SR03	PERANGINAN / RESORT
		2	SIPADAN (NORTH)	7SR04	PERANGINAN / RESORT
			SIPADAN (WEST)	7SR05	PERANGINAN / RESORT
		1	SAPI	7SM08	TAMAN LAUT / MARINE PARK
		1	MANUKAN	7SR09	PERANGINAN / RESORT
SABAH	12	1	TIGA	7SR10	PERANGINAN / RESORT
		1	KALAMPUNIAN BESAR	7SM11	TAMAN LAUT / MARINE PARK
		1	KAPALAI	7SR12	PERANGINAN / RESORT

Jadual 5.5 Malaysia: Stesen-Stesen Pulau, 2013

Table 5.5 Malaysia: Island Stations , 2013

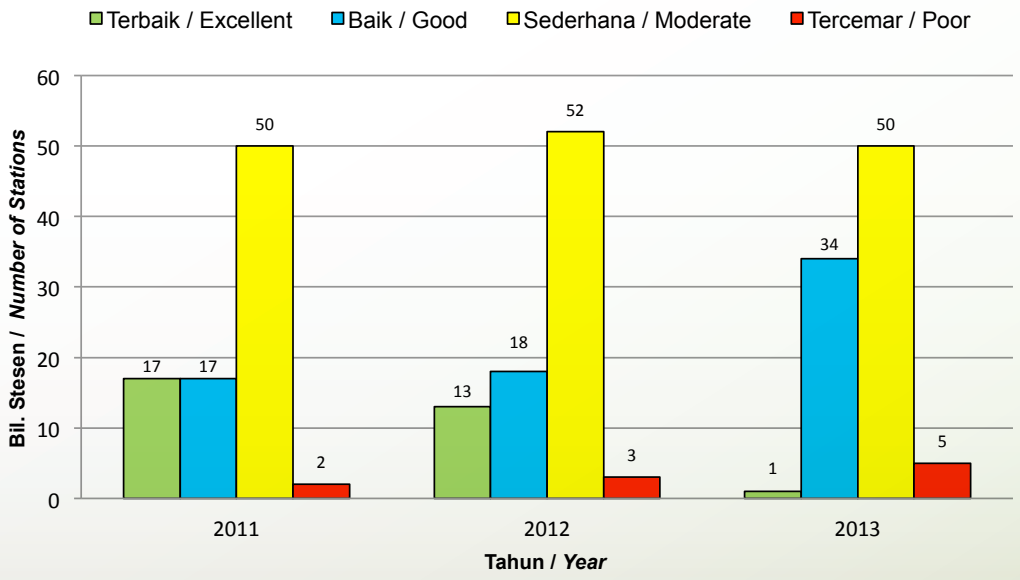
NEGERI STATE	BIL. PULAU NO. OF ISLAND	BIL. STESEN NO. OF STATION	PULAU ISLAND	NO. STESEN STATION NO	KATEGORI CATEGORY
		1	LIGITAN	7SR13	PERANGINAN / RESORT
		1	MOLLEANGAN BESAR	7SR14	PERANGINAN / RESORT
		1	BANGGI	7SR15	PERANGINAN / RESORT
		1	BALAMBANGAN	7SR16	PERANGINAN / RESORT
		1	SILINGAN	7SP17	DILINDUNGI / PROTECTED
		1	GULISAN	7SP18	DILINDUNGI / PROTECTED
		1	BAKUNGAN KECIL	7SP19	DILINDUNGI / PROTECTED
		1	BANGGI	7SR20	PERANGINAN / RESORT
		1	MANTANANI BESAR	7SR21	PERANGINAN / RESORT
LABUAN	4	4	LABUAN (POHON BATU)	7LD01	PEMBANGUNAN / DEVELOPMENT
			LABUAN (WATER FRONT)	7LD02	PEMBANGUNAN / DEVELOPMENT
			LABUAN (LUBUK TEMIANG)	7LD03	PEMBANGUNAN / DEVELOPMENT
			LABUAN (RANCHA-RANCHA)	7LD04	PEMBANGUNAN / DEVELOPMENT
		1	KURAMAN	7LM05	TAMAN LAUT / MARINE PARK
		1	RUSUKAN BESAR	7LM06	TAMAN LAUT / MARINE PARK
		1	RUSUKAN KECIL	7LM07	TAMAN LAUT / MARINE PARK

Jadual 5.5 Malaysia: Stesen-Stesen Pulau, 2013

Table 5.5 Malaysia: Island Stations , 2013

Sebanyak 74 buah pulau telah dipantau dalam tahun 2013. Pulau-pulau ini termasuk Pulau Pembangunan (3 buah pulau), Pulau Peranginan (30buah pulau), Pulau Taman Laut (29 buah pulau) dan Pulau Dilindungi (12 buah pulau). Sebanyak 90 stesen telah dipantau, dianalisis serta dilaporkan sebagai Indeks Kualiti Air Marin. Hasil analisis menunjukkan hanya (1) stsesen (1.1%) dikategorikan sebagai terbaik, 34 stesen (37.8%) dikategorikan sebagai baik, 50 stesen (55.6%) dikategorikan sebagai sederhana dan hanya lima (5) stesen (5.6%) dikategorikan sebagai tercemar. **(Rajah 5.3)**

The waters around 74 islands were monitored in 2013. They include development islands (3 islands), Resort Islands (30 islands), Marine Park Islands (29 islands) and Protected Islands (12 islands). 90 island stations were monitored and analyzed to determine the Marine Water Quality Index. The results indicated that one (1) station (1.1%) as excellent, 34 stations (37.8%) as good, 50 stations (55.6%) as moderate and 5 stations (5.6%) as poor. **(Figure 5.3)**



Rajah 5.3 Malaysia: Tren Status Kualiti Air Marin Bagi Pulau, 2012-2013

Figure 5.3: Malaysia: The Trend of Marine Water Quality Status for Islands, 2012-2013

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Kedah	Pulau / Island	Singa Besar	7KR01	72.54	79.56	74.45	Sederhana / Moderate
		Dayang Bunting	7KR02	68.99	27.51	75.91	Sederhana / Moderate
		Payar	7KM03	81.67	81.67	83.73	Baik / Good
		Kaca	7KM04	81.67	81.67	85.84	Baik / Good
		Pantai Kuah	7KD07	63.95	73.88	74.45	Sederhana / Moderate
		Pantai Chenang	7KD08	74.63	87.61	83.07	Baik / Good
		Tanjung Rhu	7KD09	78.74	94.68	69.05	Sederhana / Moderate
		Teluk Ewa	7KD10	74.88	73.36	81.15	Baik / Good
		Segantang	7KR01	-	-	84.69	Baik / Good
		Dayang Bunting	7KR02	68.99	27.51	75.91	Sederhana / Moderate
Pulau Pinang	Pulau / Island	Batu Maung	7PD01	95.58	76.78	49.71	Tercemar / Poor
		Padang Kota	7PD04	96.00	54.29	50.50	Sederhana / Moderate
		Aman	7PR05	63.01	63.01	83.95	Baik / Good
		Jerejak	7PR06	64.88	64.88	75.63	Sederhana / Moderate
		Kendi	7PR07	86.35	86.35	73.86	Baik / Good
		Rimau	7PR08	89.88	89.88	85.96	Baik / Good
		Teluk Bahang	7PD03	-	-	51.06	Sederhana / Moderate
		Gedong	7PR09	67.21	67.21	84.97	Baik / Good
Perak	Pulau / Island	Pantai Teluk Gedong	7AR01	87.21	73.35	54.52	Sederhana / Moderate
		Pantai Puteri Dewi	7AR02	78.34	83.00	74.58	Sederhana / Moderate
		Pangkor Laut	7AR03	85.62	68.44	72.07	Sederhana / Moderate
		Sembilan	7AR04	54.44	69.63	80.45	Baik / Good
		Tukun Perak	7AP05	94.18	68.69	82.35	Baik / Good
Selangor	Pulau / Island	Ketam	7BR01	80.16	88.92	87.70	Baik / Good
		Angsa	7BR02	91.18	84.89	92.07	Terbaik / Excellent
		Lumut	7BR03	39.93	84.89	56.73	Sederhana / Moderate

Jadual 5.6 Malaysia: Status Kualiti Air Marin Bagi Pulau

Table 5.6 Malaysia: Marine Water Quality Status for Islands

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Negeri Sembilan	Pulau/ Island	Arang	7NP01	81.24	81.24	68.56	Sederhana/ Moderate
Melaka	Pulau/ Island	Upeh (Point A)	7MR02	51.52	38.05	43.76	Tercemar / Poor
		Upeh (Point B)	7MR02	61.00	54.88	41.08	Tercemar / Poor
		Besar (Point A)	7MR01	75.70	72.07	56.27	Sederhana / Moderate
		Besar (Point B)	7MR01	65.99	66.67	46.81	Tercemar / Poor
		Undan (Point A)	7MP03	76.02	80.44	47.02	Tercemar / Poor
		Undan (Point B)	7MP03	51.22	68.95	55.18	Sederhana / Moderate
Johor	Pulau / Island	Setindan	7JR01	94.57	96.10	85.80	Baik / Good
		Babi Tengah	7JR02	97.00	96.20	86.92	Baik / Good
		Dayang	7JM03	96.37	95.98	87.03	Baik / Good
		Nanga Besar	7JM08	96.56	95.80	86.64	Baik / Good
		Sibu Tengah	7JM11	96.96	94.85	86.35	Baik / Good
		Pemanggil	7JM15	96.90	96.63	85.95	Baik / Good
		Kukup	7JP17	75.78	90.43	82.27	Baik / Good
		Pisang	7JP18	80.64	93.45	84.29	Baik / Good
Pahang	Pulau / Island	Tioman (Teluk Salang)	7CM01	97.75	61.15	71.84	Sederhana / Moderate
		Tioman (Kg. Nipah)	7CM01	97.85	61.35	73.89	Sederhana / Moderate
		Tulai	7CM05	97.91	61.52	73.99	Sederhana / Moderate
		Labas	7CM07	97.91	61.64	73.88	Sederhana / Moderate
		Cebeh	7CM04	97.86	53.38	73.90	Sederhana / Moderate
		Sepui	7CM08	97.86	58.86	73.90	Sederhana / Moderate
		Sembilang	7CM08	97.87	55.26	73.91	Sederhana / Moderate
		Seri Buat	7CM03	97.97	56.05	73.89	Sederhana / Moderate
		Tokong Bahara	7CM09	50.12	50.12	74.00	Sederhana / Moderate
Terengganu	Pulau / Island	Gemia	7TR01	81.96	77.43	61.96	Sederhana / Moderate
		Perhentian Besar (South)	7TM04	32.69	68.70	69.03	Sederhana / Moderate
		Perhentian Besar (West)	7TM05	55.87	71.08	67.88	Sederhana / Moderate

Jadual 5.6 Malaysia: Status Kualiti Air Marin Bagi Pulau

Table 5.6 Malaysia: Marine Water Quality Status for Islands

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Terengganu	Pulau / Island	Perhentian Kecil	7TM06	59.55	71.68	64.88	Sederhana / Moderate
		Redang (North)	7TM06	71.77	66.91	66.65	Sederhana / Moderate
		Redang (South)	7TM08	65.48	65.48	68.87	Sederhana / Moderate
		Lang Tengah	7TM11	87.63	70.44	65.89	Sederhana / Moderate
		Pinang	7TM12	88.56	62.99	68.11	Sederhana / Moderate
		Ekor Tebu	7TM13	73.82	62.83	67.51	Sederhana / Moderate
		Lima	7TM14	68.38	69.85	66.19	Sederhana / Moderate
		Kapas	7TP16	88.14	68.50	67.89	Sederhana / Moderate
Kelantan	Pulau / Island	Panjang	7DP01	76.01	62.79	65.20	Sederhana / Moderate
		Kundur	7DP02	82.47	61.16	69.22	Sederhana / Moderate
Sarawak	Pulau / Island	Satang	7QP01	61.21	92.00	58.98	Sederhana / Moderate
		Talang-Talang Kecil	7QP02	58.71	92.17	70.35	Sederhana / Moderate
		Talang-Talang Besar	7QP03	78.87	92.58	70.87	Sederhana / Moderate
Sabah	Pulau / Island	Gaya	7SR01	80.56	80.56	67.05	Sederhana / Moderate
		Mabul	7SR03	70.17	70.17	82.35	Baik / Good
		Sipadan (N)	7SR04	66.01	66.01	81.39	Baik / Good
		Sipadan (W)	7SR05	70.55	70.55	67.73	Sederhana / Moderate
		Sapi	7SM08	81.51	81.51	69.67	Sederhana / Moderate
		Manukan	7SM09	76.35	76.35	69.13	Sederhana / Moderate
		Tiga	7SR10	69.73	69.73	77.13	Sederhana / Moderate
		Kalampunian Besar	7SM11	64.74	64.74	66.79	Sederhana / Moderate
		Kapalai	7SR12	69.74	69.74	81.32	Baik / Good
		Molleangan Besar	7SR14	54.93	54.93	86.61	Baik / Good
		Banggi (South)	7SR15	60.59	60.59	84.16	Baik / Good
		Banggi (East)	7SR20	55.57	55.57	85.67	Baik / Good

Jadual 5.6 Malaysia: Status Kualiti Air Marin Bagi Pulau

Table 5.6 Malaysia: Marine Water Quality Status for Islands

NEGERI / STATE	KLASSIFIKASI STESEN / STATION CLASSIFICATION	KAWASAN / AREA	NOMBOR STESEN / STATION NUMBER	NILAI IKAM / MWQI VALUE			KATEGORI (2013) / CATEGORY (2013)
				2011	2012	2013	
Sabah	Pulau / Island	Balambangan	7SR16	80.08	80.08	84.95	Baik / Good
		Selingan	7SP17	64.77	64.77	68.34	Sederhana / Moderate
		Gulisan	7SP18	67.76	67.76	81.40	Baik / Good
		Bakungan Kecil	7SP19	64.19	64.19	84.07	Baik / Good
		Mantanani Besar	7SR21	-	-	83.41	Baik / Good
Labuan	Pulau / Island	Kuraman	7LM05	60.23	83.10	81.63	Baik / Good
		Rusukan Besar	7LM07	62.15	85.26	84.15	Baik / Good
		Rusukan Kecil	7LM06	63.35	86.21	81.68	Baik / Good
		Pohon Batu	7LD01	66.08	90.71	78.08	Sederhana / Moderate
		Water Front	7LD02	56.90	71.80	72.81	Sederhana / Moderate
		LubukTemiang	7LD03	63.45	86.23	79.85	Sederhana / Moderate
		Ranca-Ranca	7LD04	63.15	86.19	88.04	Baik / Good

Jadual 5.6 Malaysia: Status Kualiti Air Marin Bagi Pulau

Table 5.6 Malaysia: Marine Water Quality Status for Islands

STATUS KUALITI AIR MARIN

Jadual 5.7 dan **Jadual 5.8** menunjukkan senarai stesen Pantai dan Kuala yang mencapai kategori terbaik bagi tahun 2013.

STATUS OF MARINE WATER QUALITY

Table 5.7 and **Table 5.8** shows the list of coastal and estuary stations that have

BIL. / NO.	NEGERI / STATE	LOKASI / LOCATION
1	Sarawak	Kuala Pantai Nyalau

Jadual 5.7 Malaysia: Senarai Kuala Kategori Terbaik, 2013

Table 5.7 Malaysia: List Of Excellent Estuaries, 2013

BIL. / NO.	NEGERI / STATE	LOKASI / LOCATION
1	Negeri Sembilan	Port Dickson Batu 10
2	Negeri Sembilan	Port Dickson Batu 8
3	Negeri Sembilan	Pantai Cermin
4	Negeri Sembilan	Telok Pelanduk

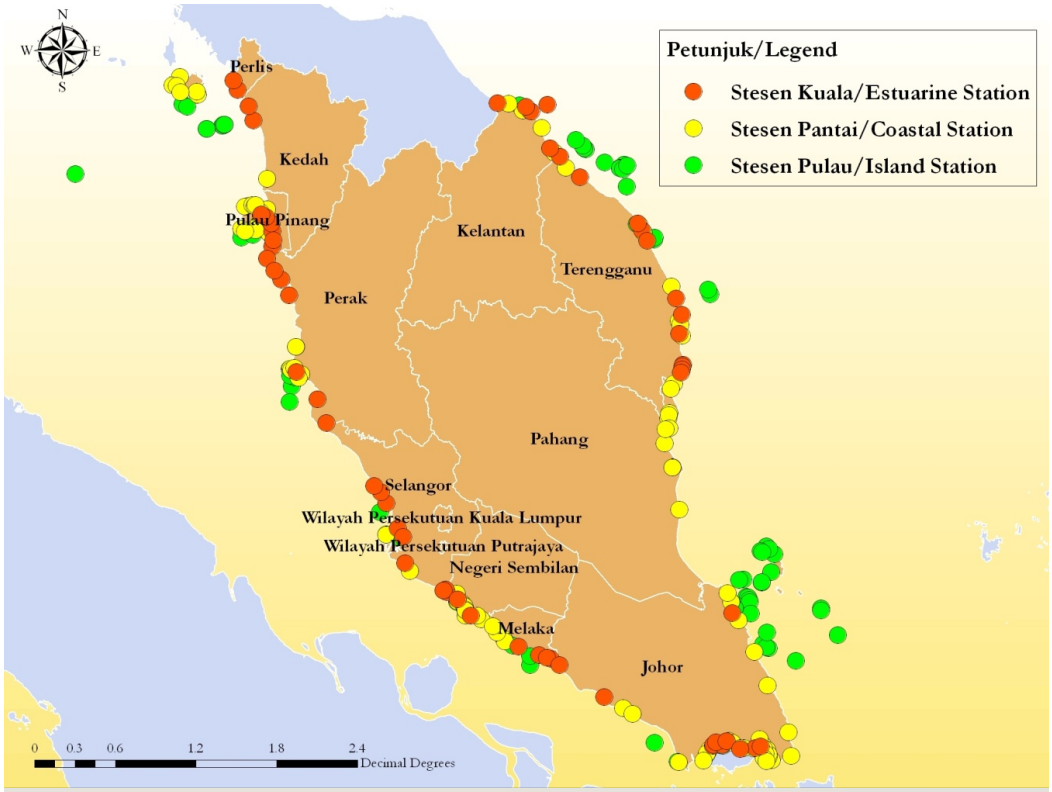
Jadual 5.8 Malaysia: Senarai Pantai Terbaik, 2013
Table 5.8 Malaysia: List Of Excellent Coastals, 2013

Stesen Pulau yang mencapai Kategori Terbaik bagi tahun 2013 adalah seperti di **Jadual 5.9.**

achieved the Excellent Category for 2013. The islands that achieve the Excellent Category for Marine Water Quality Index in 2013 are listed in **Table 5.9.**

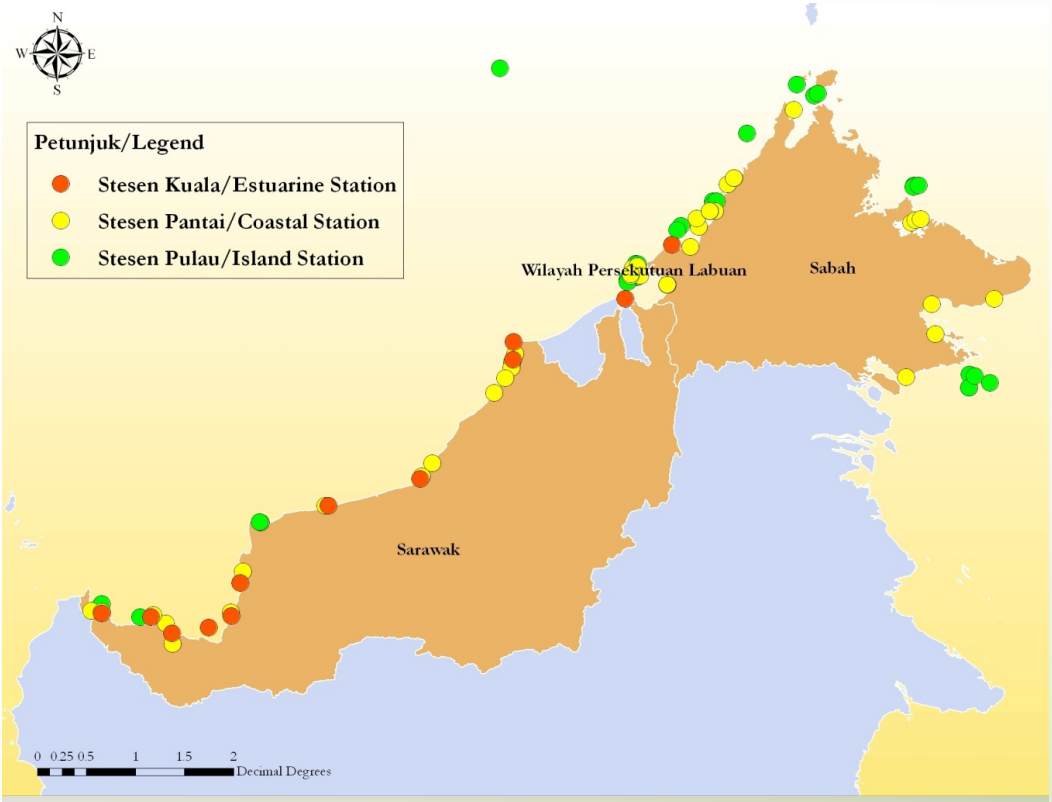
BIL. / NO.	NEGERI / STATE	PULAU / ISLAND	KATEGORI PULAU / ISLAND CATEGORY
1	Selangor	Angsa	Peranginan / Resort

Jadual 5.9 Malaysia: Senarai Pulau Terbaik, 2013
Table 5.9 Malaysia: List of Excellent Islands, 2013



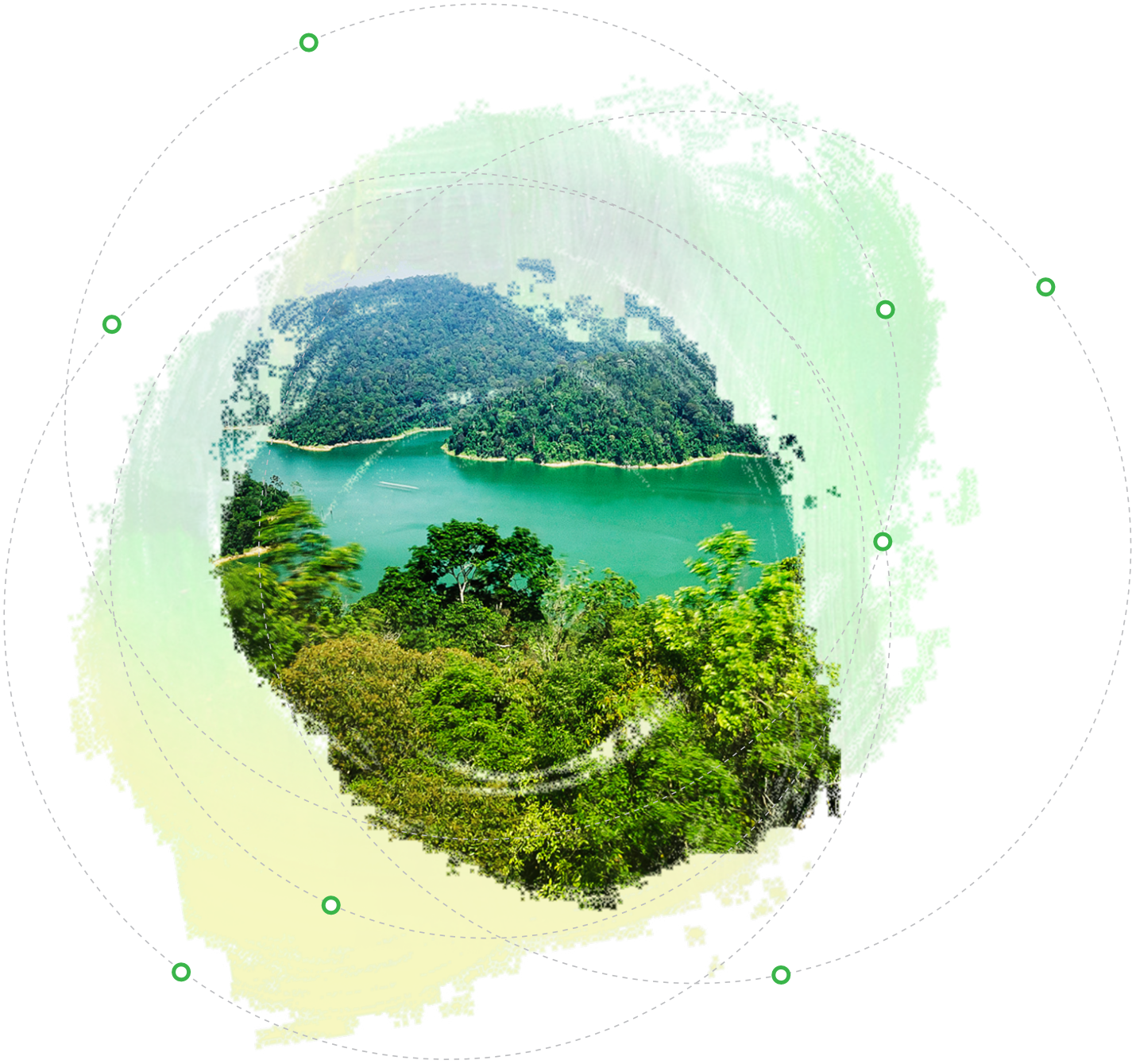
Peta 5.1: Semenanjung Malaysia: Lokasi Stesan Pengawasan Kualiti Air Marin

Map 5.1: Pennisular Malaysia: Location of Marine Water Quality Stations



Peta 5.2: Sabah & Sarawak: Lokasi Stesan Pengawasan Kualiti Air Marin

Map 5.2: Sabah & Sarawak: Location of Marine Water Quality Stations



BAB 6
CHAPTER

INVENTORI PUNCA PENCEMARAN / POLLUTION SOURCES INVENTORY

PUNCA PENCEMARAN AIR

Punca punca pencemaran air terdiri dari punca-punca tetap dan punca-punca tidak tetap. Punca-punca pencemaran tetap adalah merujuk kepada pelepasan buangan cecair ke dalam sesuatu badan air di lokasi-lokasi tertentu melalui paip-paip atau pelepasan-pelepasan tertentu. Punca-punca tetap ini merangkumi pelepasan-pelepasan dari industri, loji pengolahan kumbahan dan ladang-ladang ternakan. Punca tidak tetap merupakan punca-punca yang berselerak dan tidak mempunyai takat pelepasan buangan yang tetap seperti aktiviti-aktiviti pertanian dan air larian dari pembukaan tanah.

Dalam tahun 2013, sebanyak 1,475,444 punca-punca pencemaran air telah dikenalpasti. Ianya terdiri dari 4,595 industri pembuatan, 10,336 loji kumbahan, 1,262,185 tangki septik individu (IST),

WATER POLLUTION SOURCES

The sources of water pollution can be categorised into point and non-point sources. Point sources are referred to sources with discharges entering the body of water at specific locations, such as from pipes or outfalls. Point sources include discharges from industries, sewage treatment plants and animal farms. Non-point sources are derieved from diffused sources that do not have specific discharge points, examples of which are from agricultural activities and surface run-offs.

In 2013, a total of 1,475,444 water pollution sources were identified. These sources include pollution from 4,595 manufacturing industries, 10,336 sewage treatment plants, 1,262,185 Individual Septic Tank (IST),

3,629 tangki septik berpusat (CST), 602 ladang ternakan (ladang babi), 508 industri berasaskan pertanian, 879 pasar basah dan 192,710 perkhidmatan penyediaan makanan. **(Jadual 6.1)**

3,629 Communal Septic Tank (CST), 602 animal farm (pig farming), 508 agro-based industries, 879 wet markets and 192,710 food services establishments. **(Table 6.1)**

Bil. / No	Jenis Punca / Type of sources	Bilangan punca / No. of sources
1	Industri pembuatan / Manufacturing Industries	4,595
2	Industri berasaskan pertanian / Agro-based Industries	
	a) Kilang getah / Rubber Mills	72
	b) Kilang kelapa sawit / Palm Oil Mills	436
3	Ladang ternakan (ladang babi) / Animal farms (Pig farming)^	602
4	Logi Pengolahan kumbahan / Sewage treatment plant@"	
	• Awam / Public	5,995
	• Swasta / Private	4,341
	• Tangki septik individu / Individual Septic Tank (IST)	1,262,185
	• Tangki septik Berpusat / Communal Septic Tank (CST)	3,629
5	Perkhidmatan penyediaan makanan / Food Services Establishments*	192, 710
6	Pasar basah / Wet markets"	879
	Jumlah / Total	**1,475,444**

Jadual 6.1 Malaysia : Pecahan Punca-Punca Pencemaran Mengikut Sektor, 2013
Table 6.1 Malaysia : Composition of Water Pollution Sources by Sector, 2013

Punca-punca maklumat / Sources of information:-

* Jabatan Perangkaan Malaysia (anggaran data berdasarkan data pada 2010) / Department of Statistics Malaysia (estimated data based on 2010 data)

@ Indah Water Konsortium

" Pihak Berkuasa Tempatan / Local Authorities

^ Jabatan Perkhidmatan Veterinar / Department of Veterinary Services

BEBAN PENCEMARAN

Tiga (3) parameter utama pencemaran yang mempunyai kesan signifikan kepada kualiti air sungai adalah Biologikal Oksigen Yang DiPerlukan (BOD_5), Pepejal Terampai (SS) dan Ammoniakal Nitrogen (AN). Beban pencemaran BOD_5, SS dan AN dihuraikan di bawah.

BEBAN BIOLOGIKAL OKSIGEN YANG DIPERLUKAN

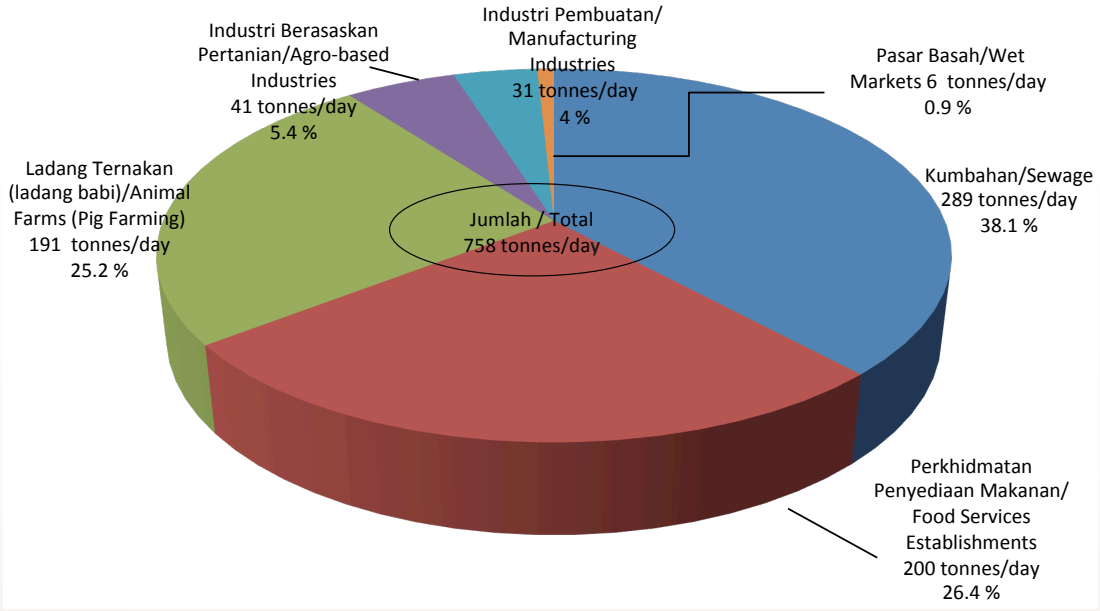
Anggaran Beban Biologikal Oksigen Yang DiPerlukan (BOD_5) yang dijana / dilepaskan dalam tahun 2013 adalah sebanyak 758 ton/hari dan kadar tersebut sebenarnya telah berkurangan sebanyak 10.6% dibandingkan pada tahun 2012 (848 ton/hari). Beban BOD_5 dari kumbahan pada tahun 2013 adalah berdasarkan kepada pelepasan yang sebenarnya, ia masih lagi merupakan penyumbang terbesar beban pencemaran ini dengan kadar sebanyak 289 ton/hari (38.1%), diikuti oleh perkhidmatan penyediaan makanan 200 ton/ hari (26.4%), ladang ternakan (ladang babi) 191 ton/hari (25.2%), industri berasaskan pertanian 41 ton/hari (5.4%), industri pembuatan 31 ton/hari (4%) dan pasar basah 6 ton/hari (0.9%) seperti ditunjukan dalam **Rajah 6.1.**

POLLUTION LOAD

The three (3) main parameters of pollutants that have significantly affected the quality of river water are Biological Oxygen Demand (BOD_5), Suspended Solids (SS) and Ammoniacal Nitrogen (AN). The BOD_5, SS and AN loadings are as described below.

BIOLOGICAL OXYGEN DEMAND LOAD

The estimated Biological Oxygen Demand (BOD_5) load in 2013, was 758 tonnes/day, which was a decrease of 10.6% as compared to 2012 (848 tonnes/day). The number of BOD_5 load for sewage in the year 2013 was based on actual discharges. Sewage remained the largest contributor with a total load of 289 tonnes/day (38.1%), followed by food services establishments which produced 200 tonnes/day (26.4%), animal farms (pig farming) 191 tonnes/day (25.2%), agro-based industries 41 tonnes/day (5.4%), manufacturing industries 31 tonnes/day (4%) and wet markets 6 tonnes/day (0.9%) as shown in **Figure 6.1.**



Rajah 6.1 Malaysia : Beban BOD_5 Mengikut Punca Pencemaran Air, 2013

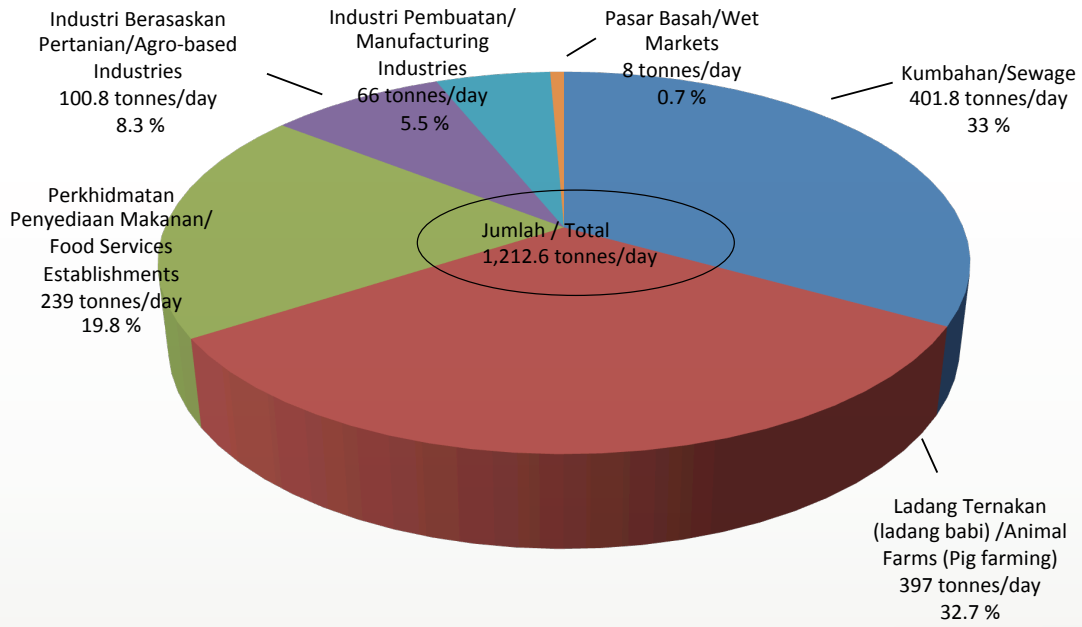
Figure 6.1 Malaysia : BOD_5 Loading by Water Pollution Sources, 2013

BEBAN PEPEJAL TERAMPAI

Anggaran Beban Pepejal Terampai (SS) dalam tahun 2013 adalah sebanyak 1,212.6 ton/hari di mana kumbahan merupakan penyumbang terbesar beban pencemaran ini dengan kadar sebanyak 401.8 ton/hari (33%), diikuti oleh ladang ternakan (ladang babi) 397 ton/hari (32.7%), perkhidmatan penyediaan makanan 239 ton/hari (19.8%), industri berasaskan pertanian 100.8 ton/hari (8.3%), industri pembuatan 66 ton/hari (5.5%) dan pasar basah 8 ton/hari (0.7%) seperti ditunjukkan dalam **Rajah 6.2**

SUSPENDED SOLIDS LOAD

The estimated total of Suspended Solids (SS) load in 2013 was 1,212.6 tonnes/day, sewage being the largest contributor with a total load of 401.8 tonnes/day (33%), followed by animal farms (pig farm) 397 tonnes/day (32.7%), food services establishments 239 tonnes/day (19.8%), agro-based industries 100.8 tonnes/day (8.3%), manufacturing Industries 66 tonnes/day (5.5%) and wet markets 8 tonnes/day (0.7%) as shown in **Figure 6.2.**



Rajah 6.2 Malaysia : Beban SS Mengikut Punca Pencemaran Air, 2013

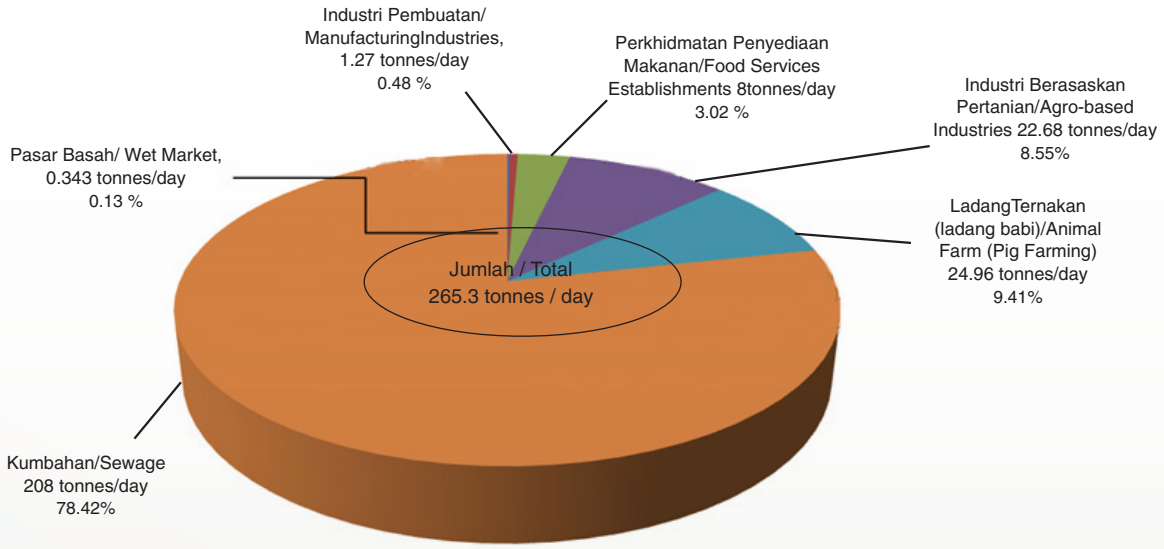
Figure 6.2 Malaysia : SS Loading by Water Pollution Sources, 2013

BEBAN AMMONIAKAL NITROGEN

Anggaran Beban Ammoniakal Nitrogen dalam tahun 2013 adalah sebanyak 265.3 ton/hari di mana kumbahan merupakan penyumbang terbesar beban pencemaran ini dengan kadar 208 ton/hari (78.4%), diikuti oleh ladang ternakan (ladang babi) 25 ton/hari (9.4%), industri berasaskan pertanian sebanyak 22.7 ton/hari (8.6%), perkhidmatan penyediaan makanan 8 ton/hari (3%), industri pembuatan 1.3 ton/hari (0.5%) dan pasar basah 0.3 ton/hari (0.1%) seperti ditunjukkan dalam **Rajah 6.3.**

AMMONIACAL NITROGEN LOAD

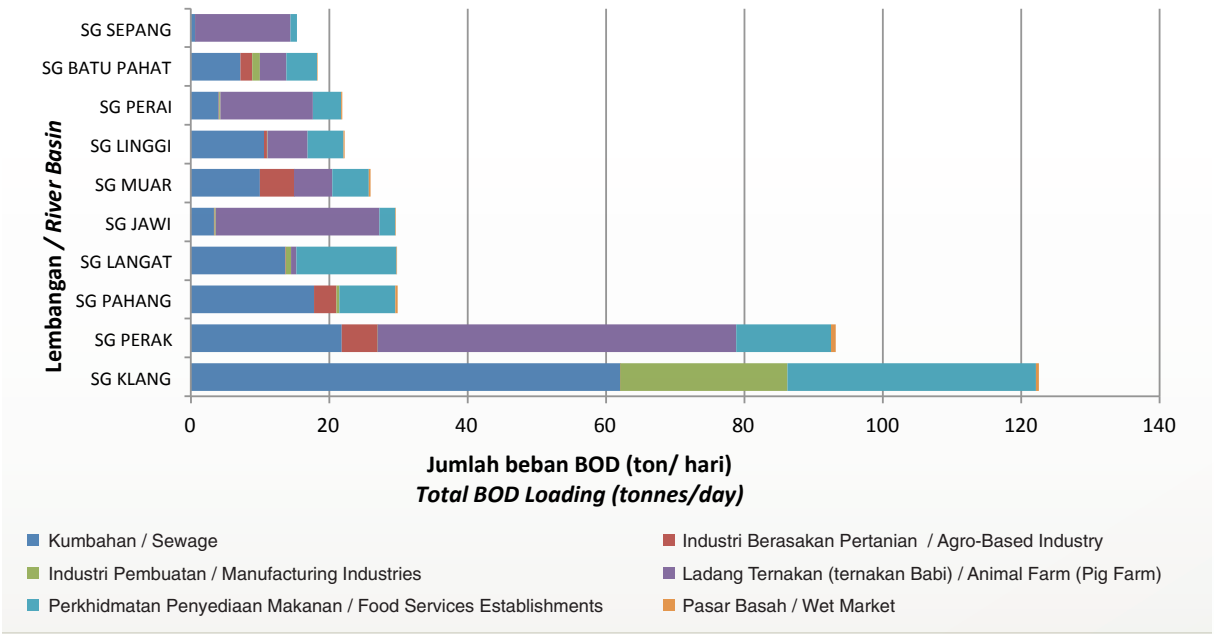
The estimated total of Ammoniacal Nitrogen (AN) load in 2013 was 265.3 tonnes/day, sewage being the largest contributor with a total load of 208 tonnes/day (78.4%), followed by animal farms (pig farming) 25 tonnes/day (9.4%), agro-based industries 22.7 tonnes/day (8.6%), food services establishments 8 tonnes/day (3%), manufacturing industries 1.3 tonnes/day (0.5%) and wet markets 0.3 tonnes/day (0.1%) as shown in **Figure 6.3.**



Rajah 6.3 Malaysia : Beban AN Mengikut Punca Pencemaran Air, 2013
Figure 6.3 Malaysia : AN Loading by Water Pollution Sources, 2013

Melalui perbandingan dengan lembangan lembangan yang ada di negara ini, Lembangan Klang (Kuala Lumpur dan Selangor) merupakan lembangan yang tertinggi telah menerima beban BOD_5 (122.5 ton/hari), diikuti Lembangan Perak (Perak) 93.2 ton/hari, Lembangan Pahang (Pahang dan Negeri Sembilan) 29.9 ton/hari, Lembangan Langat (Selangor dan Negeri Sembilan) 29.8 ton/hari, dan Lembangan Sungai Jawi (Pulau Pinang) 29.6 ton/hari. Beban BOD_5 untuk 10 lembangan tertinggi ditunjukkan di **Rajah 6.4**. Beban BOD_5 untuk lain-lain lembangan adalah dianggarkan kurang dari 26 ton/hari.

In comparison to the other river basins in the country, the Klang River Basin (Kuala Lumpur and Selangor) received the highest BOD_5 load (122.5 tonnes/day), followed by the Perak River Basin (Perak) 93.2 tonnes/day, the Pahang River Basin (Pahang and Negeri Sembilan) 29.9 tonnes/day, the Langat River Basin (Selangor and Negeri Sembilan) 29.8 tonnes/day and the Jawi River Basin (Pulau Pinang) 29.6 tonnes/day. The BOD_5 loading of the highest 10 river basins is as shown in **Figure 6.4.** The BOD_5 load for the rest of the river basins was estimated to be less than 26 tonnes/day.

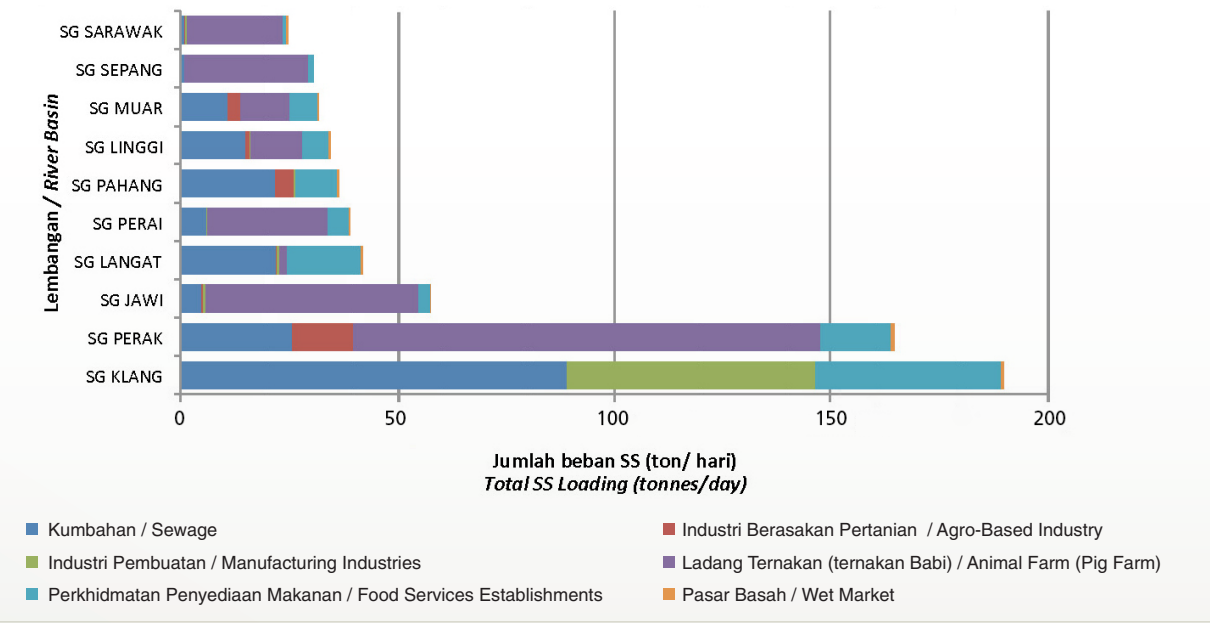


Rajah 6.4 Malaysia : Taburan Beban BOD_5 ke Dalam Lembangan dan Punca Punca Pencemaran Air, 2013

Figure 6.4 Malaysia : Distribution of BOD_5 Load by River Basin and Water Pollution Sources, 2013

Lembangan Klang telah menerima Beban SS yang tertinggi (189.7 ton/hari), diikuti Lembangan Perak 164.6 ton/hari, Lembangan Jawi 57.7 ton/hari, Lembangan Langat 41.9 ton/hari dan Lembangan Perai (Negeri Pulau Pinang) 39 ton/hari. Beban SS untuk10 lembangan tertinggi ditunjukkan di **Rajah 6.5.** Beban SS untuk lain-lain lembangan adalah dianggarkan kurang dari 37 ton/hari.

The Klang River Basin continued to receive the highest SS Load (189.7 tonnes/day), followed by the Perak River Basin 164.6 tonnes/day, the Jawi River Basin 57.7 tonnes/ day, the Langat River Basin 41.9 tonnes/day and the Perai River Basin Pulau Pinang 39 tonnes/day. The SS loading for the highest 10 river basins is as shown in **Figure 6.5**. The SS load for the rest of the river basins was estimated to be less than 37 tonnes/ day.

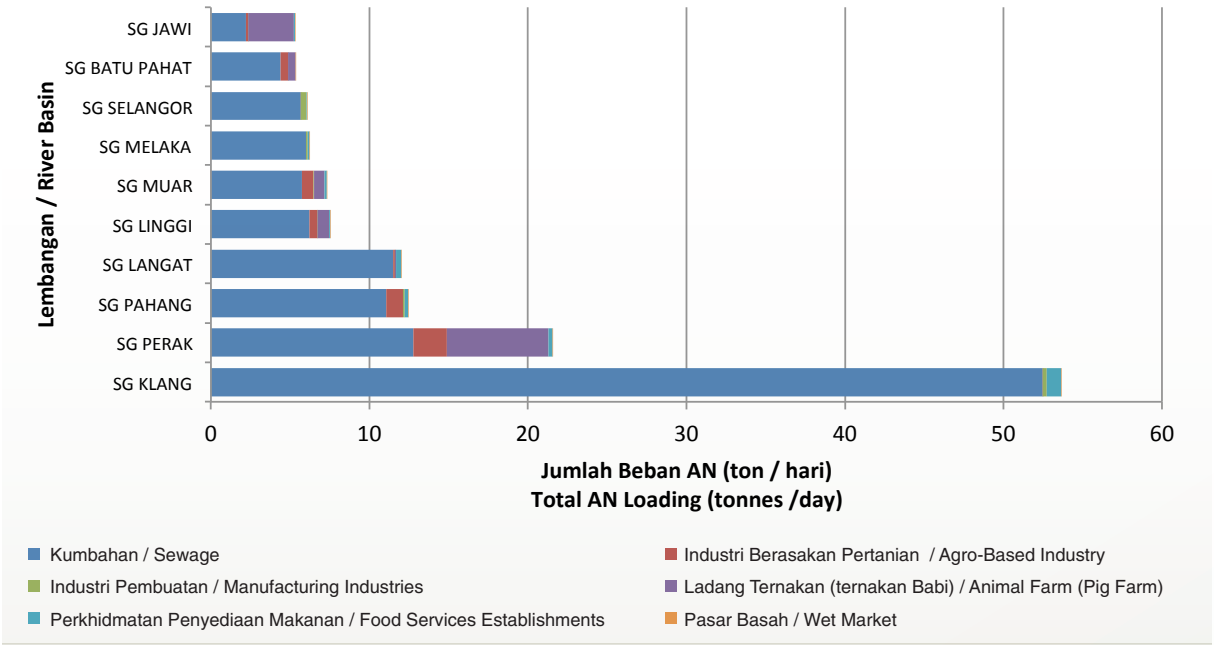


Rajah 6.5 Malaysia : Taburan Beban SS ke dalam lembangan dan punca punca pencemaran air, 2013

Figure 6.5 Malaysia : Distribution of SS Load by river basin and water pollution sources, 2013

Lembangan Klang telah menerima beban AN yang tertinggi (54.1 ton/hari), diikuti Lembangan Perak 21.8 ton/hari, Lembangan Pahang 12.5 ton/hari, Lembangan Langat (Selangor & Negeri Sembilan) 12.2 ton/ hari dan Lembangan Linggi (Negeri Sembilan & Melaka) 7.6 ton/hari. Beban AN untuk 10 lembangan tertinggi ditunjukkan di dalam **Rajah 6.6.** Beban AN untuk lain-lain lembangan adalah dianggarkan kurang dari 7.5 ton/hari.

The Klang River Basin received the highest AN Load (54.1 tonnes/day), followed by Perak River Basin 21.8 tonnes/day, Pahang River Basin 12.5 tonnes/day, Langat River Basin (Selangor & Negeri Sembilan) 12.2 tonnes/day and Linggi River Basin (Negeri Sembilan & Melaka) 7.6 tonnes/day. The AN loading for the same 10 river basins is as shown in **Figure 6.6.** The AN load for the rest of the river basins was estimated to be less than 7.5 tonnes/day.



Rajah 6.6 Malaysia : Taburan Beban AN ke dalam lembangan dan punca punca pencemaran air, 2013

Figure 6.6 Malaysia : Distribution of AN Load by river basin and water pollution sources, 2013

PENYEDIAAN GEO-INFORMATION SPATIAL (GIS)

Sehingga tahun 2013, kemasukan data-data inventori ke dalam Geo-Information Spatial (GIS) sedang dilaksanakan untuk lembangan Langat, Lembangan Muar, Lembangan Muda, Sungai Bertam (Cameron Highlands) dan Lembangan Klang (River of Life) seperti dalam **Jadual 6.2.**

GEO-INFORMATION SPATIAL (GIS) PROVISION

Until 2013, the entry of inventory data into the Geo-Spatial Information (GIS) was implemented for the Langat River Basin, the Muar River Basin, the Muda River Basin, the Bertam River (Cameron Highlands) and the Klang River Basin (River of Life), as shown in **Table 6.2.**

	KATEGORI / CATEGORY	LANGAT	MUAR	MUDA	BERTAM (Cameron Highlands)	KLANG (RoL)
1	Perkhidmatan Makanan / Food Services Establishments	3,562	2,085	228	175	5,564
2	Ternakan babi / Pig Farms	4	11	0	0	0
3	Pasar basah/ Wet Markets	27	38	11	3	29
4	Loji kumbahan / Sewage plants	487	178	32	58	455
5	Kilang kelapa sawit / Palm Oil Mills	10	14	4	0	0
6	Kilang getah / Rubber Factories	0	14	6	0	0
7	Kemudahan Pengolahan BT / BT Processing Facilities	33	3	2	0	9
8	Industri / Industries	367	700	190	8	577
9	Tapak pelupusan sampah / Landfill	8	10	5	1	29
10	Kuari / Quarries	11	10	4	1	5
	JUMLAH / TOTAL	**4,550**	**3,067**	**557**	**316**	**6,677**

Jadual 6.2 Malaysia : Punca Pencemaran Mengikut Kategori dan Lembangan Sungai

Table 6.2 Malaysia : Pollution Source Categories by River Basins

PUNCA - PUNCA PENCEMARAN UDARA

Industri termasuklah loji janakuasa, kenderaan bermotor dan aktiviti pembakaran terbuka merupakan punca utama pencemaran udara di negara ini.

Sehingga bulan Disember 2013, jumlah punca industri yang tertakluk di bawah Peraturan-Peraturan Kualiti Alam Sekeliling (Udara Bersih) 1978 adalah sebanyak 14,011. Jumlah ini berkurangan sebanyak 1,470 berbanding pada tahun 2012 (15,481). Ini jelas menunjukkan penurunan yang ketara dari segi bilangan punca industri yang telah direkodkan pada tahun 2012 iaitu sebanyak 15,481. Pecahan punca industri berdasarkan negeri adalah seperti **Rajah 6.7.** Bilangan punca pencemar yang tertinggi adalah di Selangor (2,910: 20.8%) diikuti Johor (2,270:16.2%) dan Sarawak (1,681:12.0%)

SOURCES OF AIR POLLUTION

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

As of December 2013, a total of 14,011 industrial sources were identified to be subjected to the Environmental Quality (Clean Air) Regulations, 1978, down by 1,470 as compared to 2012, that recorded a total of 15,481 sources. The distribution of industrial sources by states is as shown in **Figure 6.7.** The highest number of stationary pollution sources was found in Selangor (2,910: 20.8%), followed by Johor (2,270: 16.2%) and Sarawak (1,681: 12.0 %).

Seperti tahun-tahun yang lepas, kenderaan bermotor merupakan punca utama yang menyumbang kepada pencemaran udara terutamanya di kawasan bandar. Pada tahun 2013, terdapat peningkatan bagi jumlah keseluruhan kenderaan bermotor yang didaftarkan. Bilangan pendaftaran yang direkodkan bagi kenderaan penumpang meningkat sebanyak 1.74%, motosikal 4.70%, kenderaan barangan 8.16% dan teksi 7.40% berbanding pada tahun 2012, manakala bilangan bagi bas berkurangan sebanyak 14.62% (73,536:2012), (62,784:2013). Pendaftaran kenderaan bermotor yang direkodkan oleh Jabatan Pengangkutan Jalan pada tahun 2012 dan 2013 adalah seperti yang ditunjukkan dalam **Rajah 6.8.** Walau bagaimanapun, bilangan bagi kenderaan terpakai dan yang masih aktif menunjukkan tren penurunan, di mana bilangan bagi motosikal berkurangan sebanyak 3.46%, kenderaan barangan 2.0% pengurangan, teksi 0.28% pengurangan dan bas 10.42% pengurangan jika dibandingkan dengan tahun 2012 **(Rajah 6.9).** Manakala, bagi kenderaan penumpang, ianya masih menunjukkan peningkatan sebanyak 2.99% berbanding tahun 2012.

Motor vehicles remained the major source of air pollution especially in urban areas, over the past years. In 2013, there was an overall increase in the number of motor vehicles registered. The number of registered passenger cars increased by 1.74%, motorcycles 4.70%, goods vehicles 8.16% and taxi 7.40%, as compared to 2012, while the number of buses decreased by 14.62% (73,536:2012), (62,784:2013). The total number of registered vehicles in Malaysia, as reported by the Road Transport Department for 2012 and 2013, is shown in **Figure 6.8.** In addition to this, the number of in-use vehicles or vehichels that are active on the road also showed a downward trend, with motorcycles recording a decrease of 3.46%, goods vehicles by 2.0%, taxis by 0.28% and buses which showed a decrease of 10.42%, as compared to 2012 **(Figure 6.9).** Meanwhile, passenger vehicles trended upwards by 2.99% in 2013, as compared to 2012.

BEBAN PENCEMARAN PENCEMAR UDARA

Beban Pencemaran Secara Menyeluruh

Dianggarkan pada tahun 2013, keseluruhan beban pencemaran yang terkumpul bagi pencemar karbon monoksida (CO) adalah

AIR POLLUTANT EMISSION LOAD

Overall Emission Load

It was estimated in 2013 that the combined air pollutant emission load accumulated to 1,874,836 metric tonnes of carbon

1,874,836 metrik tan; 858,048 metrik tan bagi nitrogen dioksida (NO_2); 198,920 metrik tan bagi sulfur dioksida (SO_2) dan 24,006 metrik tan bagi jirim zarah terampai (PM). Perbezaan keseluruhan beban pencemaran bagi tahun 2012 dan 2013 adalah ditunjukkan dalam **Rajah 6.10.**

Beban pencemaran bagi NO_2 adalah berkurangan pada tahun 2013 berbanding dengan tahun 2012 disebabkan pengurangan jumlah kenderaan yang beroperasi atau yang masih aktif terutamanya bas. Peningkatan sebanyak 0.06% beban pencemaran CO dan 0.2% bagi SO_2 berbanding dengan tahun 2012 adalah disebabkan penggunaan arang batu sebagai bahan api dalam industri manakala peningkatan ketara beban pencemar PM pula mungkin disebabkan penggunaan bahan api minyak dan arang batu yang tinggi sebagai bahan api dalam industri dan loji janakuasa. (Sumber: National Energy Balance, 2011)

Punca Beban Pencemaran

Loji janakuasa merupakan penyumbang utama kepada beban pencemar SO_2 (50%), diikuti dengan lain-lain kategori (34%), industri (9%) dan kenderaan bermotor (7%) **(Rajah 6.11).** Bagi beban pencemar PM pula, penyumbang terbesar adalah daripada industri (30%), diikuti oleh loji janakuasa (27%), lain-lain kategori (25%) dan kenderaan bermotor (18%) **(Rajah 6.12).** Seperti yang ditunjukkan dalam **Rajah 6.13**, penyumbang terbesar bagi

monoxide (CO); 858,048 metric tonnes of nitrogen oxides (NO_2); 198,920 metric tonnes of sulphur dioxide (SO_2) and 24,006 metric tonnes of particulate matter (PM). A comparison of the combined air pollutant emission load in 2012 and 2013 is as shown in **Figure 6.10.**

The emission load for NO_2 had improved in 2013 as compared to 2012 due to the decrease in the number of in-use or active motor vehicles on the roads, especially buses. The increased of 0.06% in CO emission load and 0.2% in SO_2 emission load, compared to 2012, was due to the consumption of coal as a form of fuel within industries, while the significant increase in emission load for PM could be due to high usage of fuel oil and coal, used as fuel in industries such as power and heat generation plants. (Sources: National Energy Balance 2011).

Emission Load by Sources

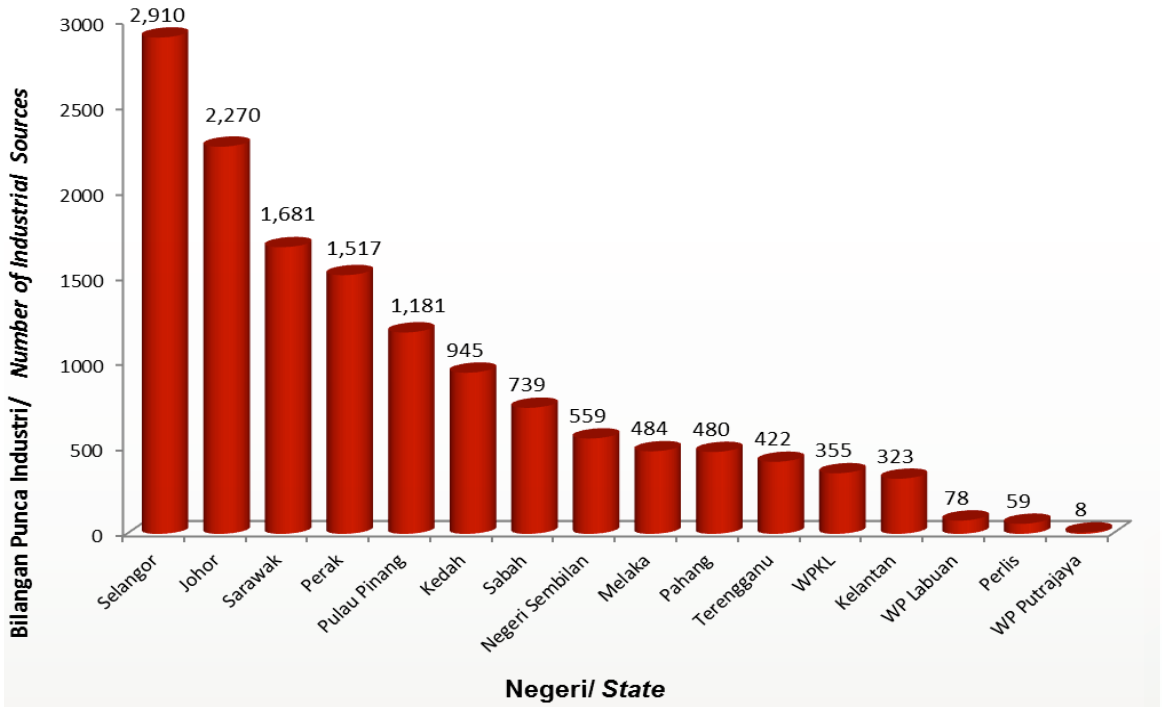
Power plants contributed the highest SO_2 emission loads (50%), followed by others (34%), industries (9%) and motor vehicles (7%) **(Figure 6.11).** As for PM, the highest contributors were industries (30 %) followed by power plants (27%), others (25%) and motor vehicles (18%) **(Figure 6.12)**. As shown in **Figure 6.13**, the highest contributor of NO_2 was power plants (61%) followed by motor vehicles (26%), others (7%) and industries (6 %). Motor vehicles,

NO_2 adalah daripada loji janakuasa (61%) diikuti kenderaan bermotor (26%), lain-lain kategori (7%) dan industri (6%). Walau bagaimanapun, kenderaan bermotor masih merupakan penyumbang terbesar kepada CO (95.3%) **(Rajah 6.14).**

Anggaran pencemaran yang dihasilkan oleh beban pencemar udara iaitu HC, CO, PM, NO_2 dan CO_2 daripada kenderaan bermotor pada tahun 2012 dan 2013 ditunjukkan dalam **Rajah 6.15.** Pada tahun 2013, beban pencemaran bagi pencemar HC dan CO dianggarkan 417,953 metrik tan dan 1,786,411 metrik tan masing-masing. Terdapat peningkatan sebanyak 0.39% bagi beban pencemaran CO jika dibandingkan dengan tahun 2012. Walau bagaimanapun, beban pencemaran bagi HC berkurangan sebanyak 1.99% pada tahun 2013. Tren penurunan yang sama juga dilihat bagi beban pencemaran yang dihasilkan oleh SO_2, NO_2, PM daripada kenderaan bermotor pada tahun 2013. Beban pencemaran yang dihasilkan oleh pencemar PM adalah 4,339 metrik tan pada tahun 2013 berbanding 4,584 metrik tan pada tahun 2012 (berkurangan sebanyak 5.37%); SO_2 sebanyak 14,053 metrik tan pada tahun 2013 berbanding pada 14,391 metrik tan pada tahun 2012 (berkurangan sebanyak 2.35%) dan NO_2 sebanyak 220,789 metrik tan pada tahun 2013 berbanding 226,209 metrik tan pada tahun 2012 (berkurangan sebanyak 2.40%)

however, remained the highest contributor of CO (95.3 %) **(Figure 6.14).**

The estimated annual air pollutant emission load of HC, CO, PM, NO_2 and SO_2 from motor vehicles for 2012 and 2013, are shown in **Figure 6.15**. In 2013, the emission load of HC and CO were estimated to be 417,953 metric tonnes and 1,786,411 metric tonnes, respectively. This was an increase of 0.39% of CO emission load compared to 2012. However, the emission load of HC decreased by 1.99% in 2013. A similar decreasing trend was also observed for SO_2, NO_2 and PM emission load from motor vehicles in 2013. Emission load from PM was recorded at 4,339 metric tonnes in 2013 as compared to 4,584 metric tonnes in 2012 (5.37% decrease); SO_2 was 14,053 metric tonnes in 2013 as compared to 14,391 metric tonnes in 2012 (2.35% decrease); and NO_2 was 220,789 metric tonnes as compared to 226,209 metric tonnes in 2012 (2.40% decrease).

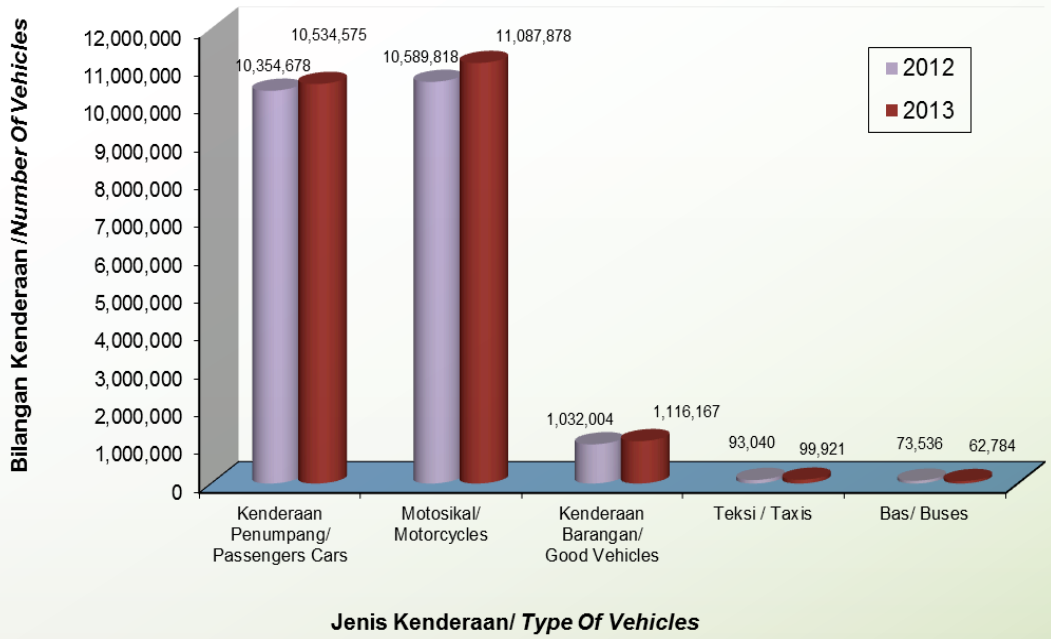


(Sumber: Sistem Inventori Pencemaran Alam Sekitar (SIMPAS), Jabatan Alam Sekitar)

(Sources: Environmental Pollution Inventory System (SIMPAS), Department of Environment, 2013)

Rajah 6.7 Malaysia: Punca Pencemaran Udara Mengikut Negeri, 2013

Figure 6.7 Malaysia: Industrial Air Pollution Sources by State, 2013

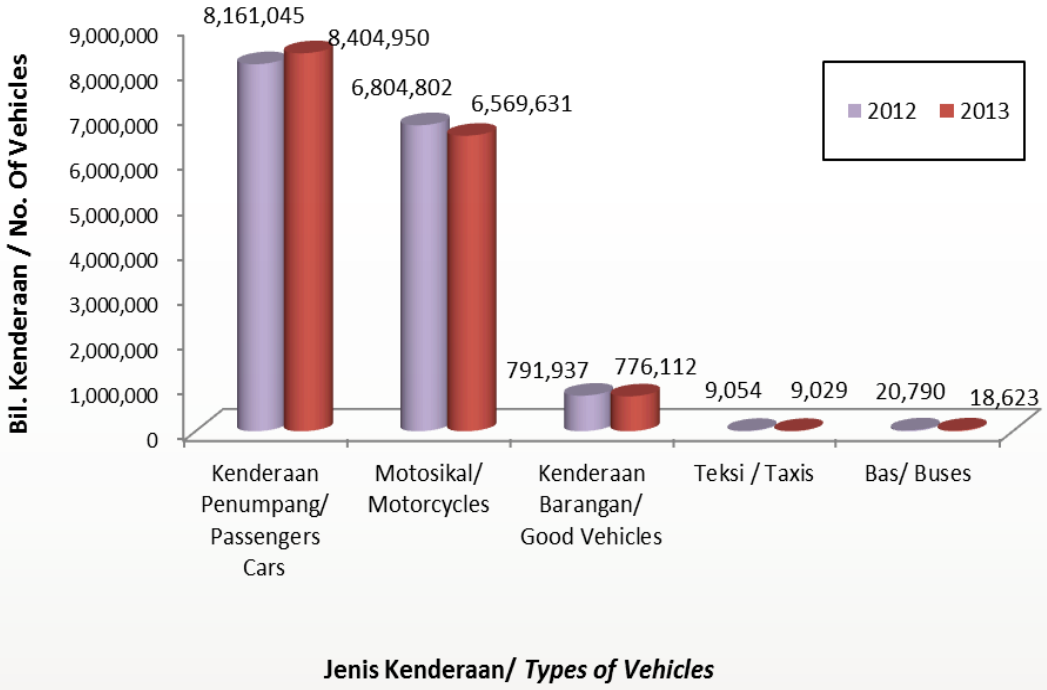


(Sumber: Jabatan Pengangkutan Jalan , Malaysia 2013)

(Source: Road Transport Department, Malaysia, 2013)

Rajah 6.8 Malaysia: Bilangan Kenderaan Berdaftar Tahun 2012-2013

Figure 6.8 Malaysia: Number of Registered Vehicles in 2012 – 2013

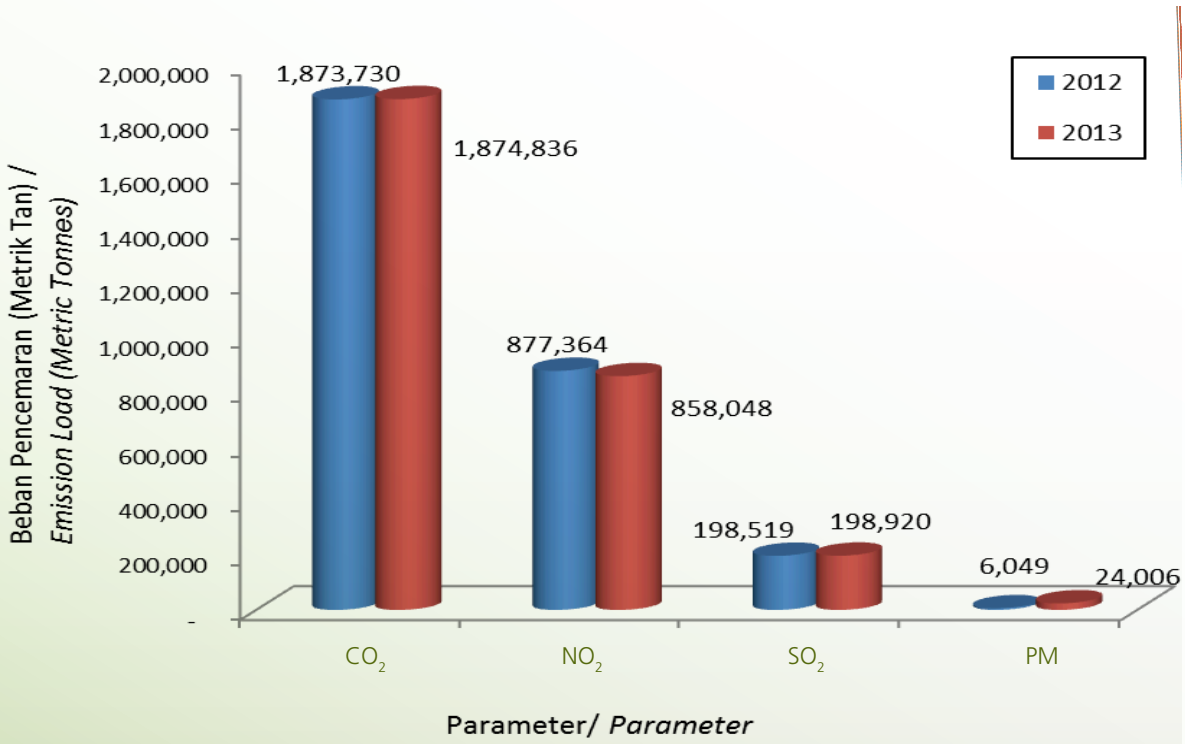


(Sumber: Jabatan Pengangkutan Jalan, Malaysia 2013)

(Source: Road Transport Department, Malaysia, 2013)

Rajah 6.9 Malaysia: Bilangan Kenderaan Terpakai Tahun 2012-2013

Figure 6.9 Malaysia: Number of in Use Vehicles in 2012-2013

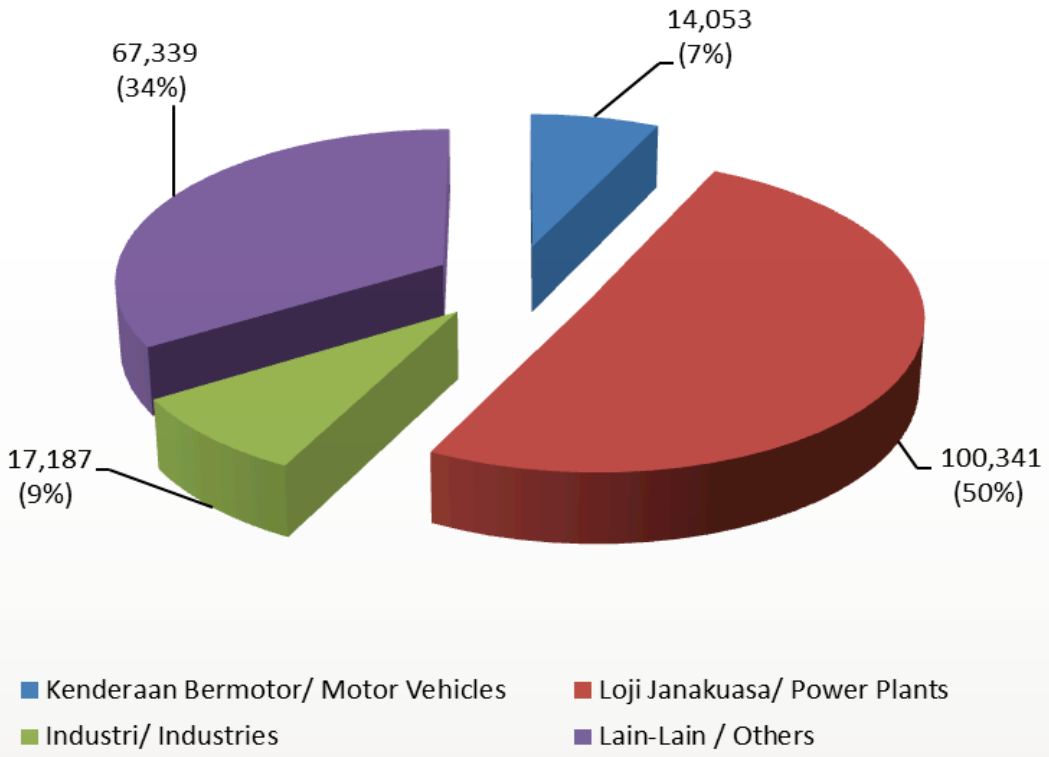


(Sumber: Dari National Energy Balance 2011)

(Sources: From National Energy Balance 2011)

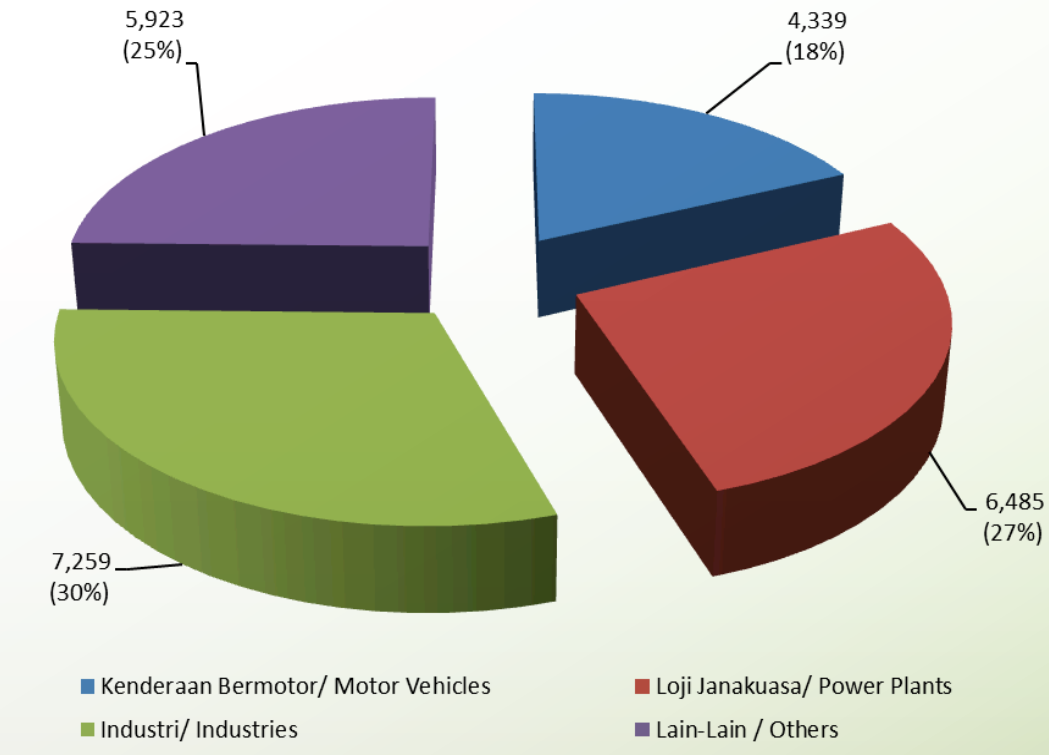
Rajah 6.10 Malaysia: Beban Pencemaran Bahan Pencemar Udara Dari Semua Punca, 2012-2013

Figure 6.10 Malaysia: Air Pollutant Emission Load from All Sources, 2012-2013



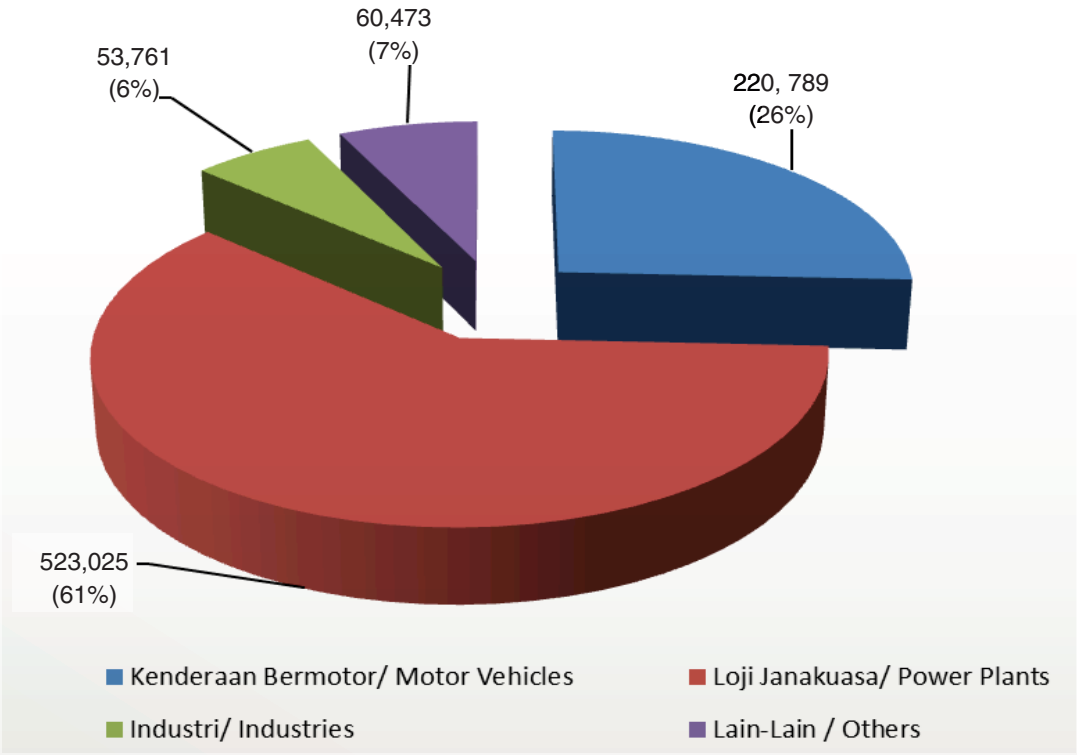
Rajah 6.11 Malaysia: Punca Pecemaran SO_2 (Metrik Tan), 2013

Figure 6.11 Malaysia: SO_2 Emission by Sources (Metric Tonnes), 2013



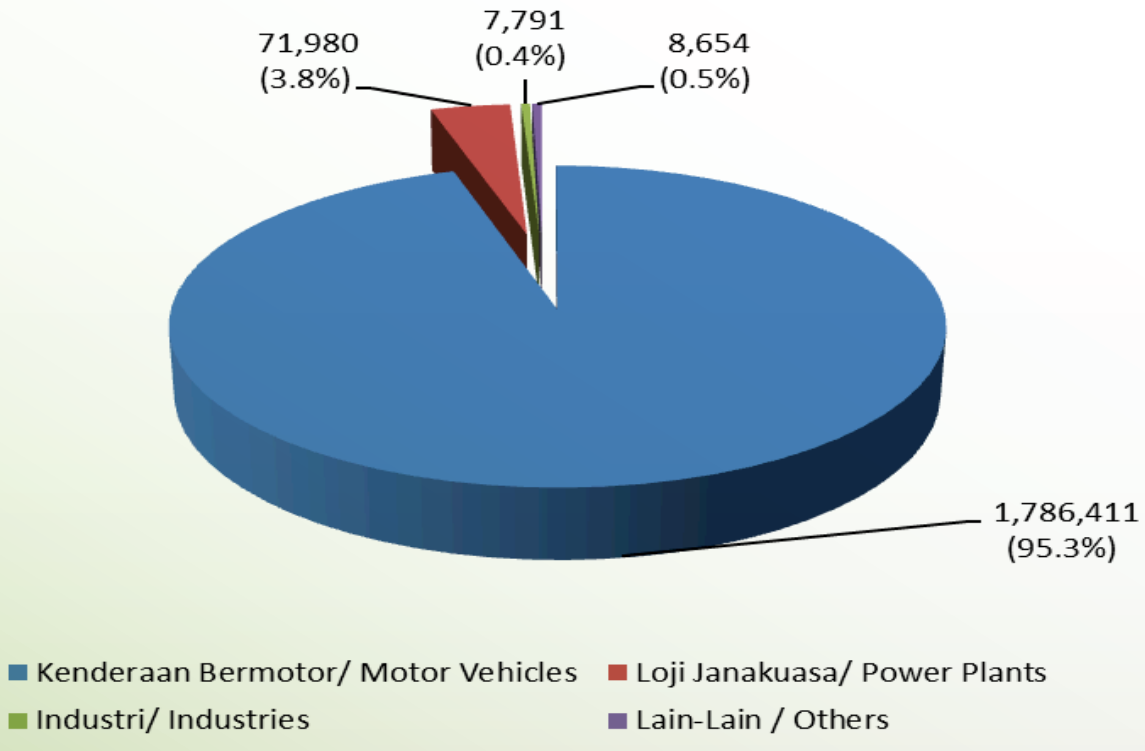
Rajah 6.12 Malaysia: Punca Beban Pencemaran Jirim Zarahan (PM) (Metrik Tan), 2013

Figure 6.12 Malaysia: Particulate Matter (PM) Emission Load by Sources (Metric Tonnes), 2013



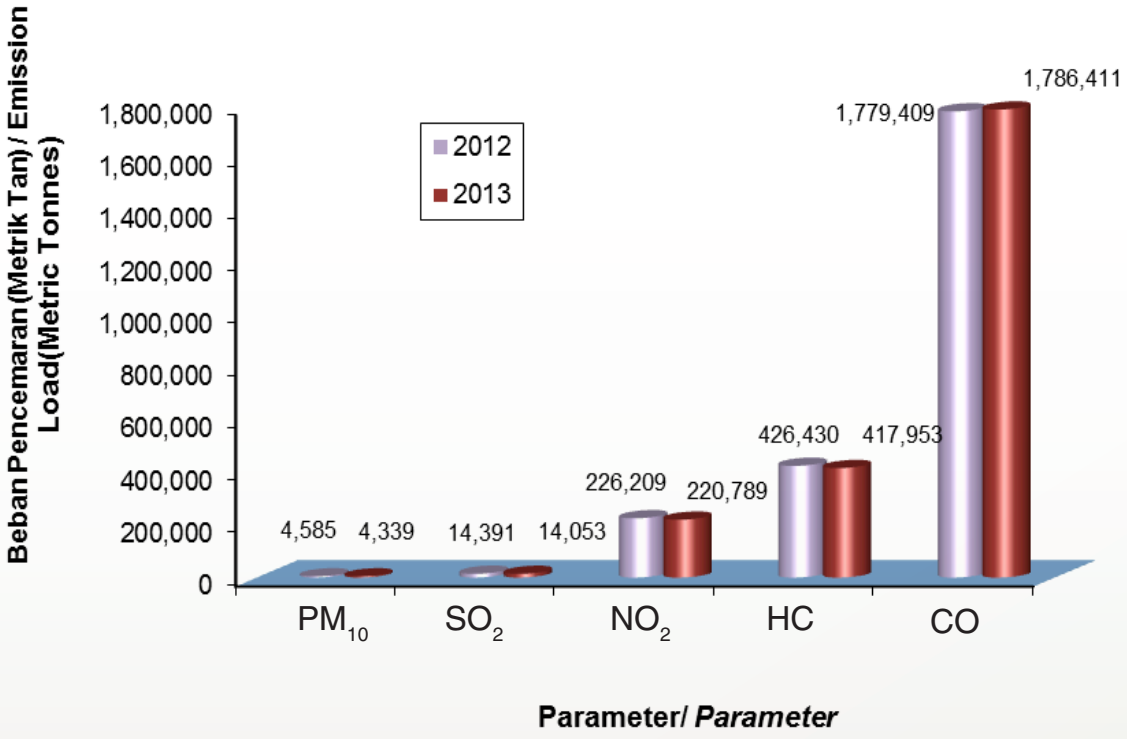
Rajah 6.13 Malaysia: Punca Pencemaran NO_2 (Metrik Tan), 2013

Figure 6.13 Malaysia: NO_2 Emission by Sources (Metric Tonnes), 2013



Rajah 6.14 Malaysia: Punca Pencemaran CO (Metrik Tan), 2013

Figure 6.14 Malaysia: CO Emission by Sources (Metric Tonnes), 2013



Rajah 6.15 Malaysia: Beban Pencemaran Pencemar Udara Dari Kenderaan Bermotor, 2012-2013

Figure 6.15 Malaysia: Air Pollutant Emission Load from Motor Vehicles, 2012-2013

INVENTORI BUANGAN TERJADUAL

Pada tahun 2013, sebanyak 2,965,611.65 tan metrik buangan terjadual telah dihasilkan. Ini mewakili peningkatan keseluruhan sebanyak 3.89% berbanding 2,854,516.78 tan metrik yang dilaporkan pada 2012. Buangan gipsum, dros / sanga / klinker / abu, minyak pelincir terpakai, enapcemar logam berat dan bekas tercemar merupakan kategori utama dalam kategori buangan yang dihasilkan**(Jadual 6.3).** Merujuk kepada **Rajah 6.16**, Negeri Terengganu menjana jumlah terbesar buangan terjadual (29.78%), diikuti oleh Negeri Perak (17.98%), Selangor (16.68%), Johor (12.28%), Pulau Pinang (9.99%), manakala 10 negeri-negeri yang lain menghasilkan sebanyak 13.28%.

Sebanyak 570,214.58 tan metrik (19.23%) daripada jumlah buangan yang dihasilkan diperoleh kembali di dalam dan luar negara.

SCHEDULED WASTES INVENTORY

In 2013, the total number of scheduled wastes produced was 2,965,611.65 metric tonnes, which shows an overall increase of 3.89% as compared to 2012, where only 2,854,516.78 metric tonnes of scheduled wastes was reported. Gypsum, dross/slag/clinker/ash, spent lubricating oil, heavy metal sludge and contaminated containers, were the main categories of the total number of wastes generated **(Table 6.3).** The state of Terengganu produced the largest volume of scheduled wastes (29.78%), followed by Perak (17.98%), Selangor (16.68%), Johor (12.28%) and Pulau Pinang (9.99%), whilst the other remaining 10 states generated a total of 13.28%, collectively **(Figure 6.16)**.

A total of 570,214.58 metric tonnes (19.23%) of wastes were being recovered locally and abroad. This showed a decrease

Ini menunjukkan penurunan sebanyak 5.07% berbanding 600,672.99 tan metrik pada tahun 2012. Daripada jumlah itu, 566,506.51 tan metrik (19.10%) daripada buangan terjadual yang diperolehkembali di kemudahan pemerolehan kembali luar tapak tempatan dan 3,708.07 tan metrik (0.13%) telah dieksport untuk pemerolehan kembali di kemudahan di luar negara.

of 5.07% as compared to 600,672.99 metric tonnes in 2012. Overall, 566,506.51 metric tonnes (19.10%) of scheduled wastes were recovered at local off-site facilities and 3,708.07 metric tonnes (0.13%) were exported for recovery at foreign facilities.

Sebanyak 131,190.20 tan metrik (4.42%) daripada jumlah buangan terjadual yang dihasilkan, dirawat dan dilupuskan untuk pelupusan akhir, iaitu di Kualiti Alam Sdn. Bhd (111,860.20 MT), Trienekens (Sarawak) Sdn. Bhd (19,330.00 MT) dan 18,201.05 tan metrik (0.61%) daripada buangan klinikal telah dibakar di kemudahan luar tapak yang dilesenkan **(Jadual 6.5)**. Jumlah ini menunjukkan penurunan sebanyak 5.66% daripada sejumlah 139,084.41 tan metrik sisa berjadual dilupuskan pada tahun 2012.

A total of 131,190.20 metric tonnes (4.42%) of wastes were treated and placed for final disposal at Kualiti Alam Sdn. Bhd. (111,860.20 MT) and Trienekens (Sarawak) Sdn. Bhd. (19,330.00 MT) and 18,201.05 metric tonnes (0.61%) of clinical wastes were incinerated at licensed off-site facilities **(Table 6.5).** This amount indicates a decrease of 5.66% from a total of 139,084.41 metric tonnes of scheduled wastes disposed in 2012.

Sebanyak 630,221.40 tan metrik (21.25%) daripada buangan terjadual terhasil telah diolah di tapak; manakala 41,742.48 tan metrik (1.41%) telah distor di premis pengeluar buangan **(Jadual 6.5)**. Dua (2) kemudahan pengolahan di atas tanah dan 15 insinerator dalam tapak telah dilesenkan oleh Jabatan Alam Sekitar bagi membolehkan rawatan dan pembakaran dalam tapak.

The total of scheduled wastes treated on-site were 630,221.40 metric tonnes; (21.25%) while 41,742.48 metric tonnes (1.41%) were stored on-site at wastes generator's premises **(Table 6.5)**. To allow for on-site treatment and incineration, the DOE have licensed two (2) land farms and 15 on-site wastes incinerators, respectively.

Daripada jumlah buangan terjadual yang dihasilkan pada tahun 2013, 1,574,041.95

Of the total wastes produced in 2013, 1,574,041.95 metric tonnes (53.08%) were

tan metrik (53.08%) telah diberi kelulusan bersyarat di bawah pengurusan khas seperti yang ditetapkan di bawah Peraturan 7, Peraturan Kualiti Alam Sekeliling (Buangan Terjadual), 2005 **Jadual 6.5**. Jumlah ini merupakan peningkatan sebanyak 37.37% berbanding 1,145,808.05 tan metrik pada tahun 2012. Kebanyakan buangan dihasilkan dari loji jana kuasa arang batu (55.10%), enap cemar daripada kemudahan rawatan air minuman (31.25%) dan lain-lain (13.65%) .

granted conditional approval to be managed under special management as stipulated under Regulation 7, Environmental Quality (Scheduled Wastes) Regulations, 2005 **Table 6.5**. The amount represented an increase of 37.37% as compared to only 1,145,808.05 metric tonnes in 2012. These waste streams were mostly generated from coal-fired power plant (55.10%), sludges from drinking water treatment facilities (31.25%) and others (13.65%).

No	Jenis Industri / Name of Waste	Kod Buangan / Waste Code	Jumlah Buangan / Quantity of Waste	
			(MT/Year / Tahun)	Peratus / Percentage (%)
1	Gipsum / Gypsum	SW 205	577,801.55	41.6327
2	Dros/ sanga/ klinker/ abu / Dross/Slag/Dust/Ash	SW 104	122,262.25	8.8094
3	Minyak Pelincir Terpakai / Spent Lubricating oil	SW 305	105,482.65	7.6004
4	Enap cemar logam berat / Heavy Metal Sludge	SW 204	103,944.37	7.4896
5	Bekas tercemar / Contaminated Container	SW 409	609,62.17	4.3925
6	Buangan elektronik / E-Waste	SW 110	52,978.13	3.8173
7	Asid Terpakai / Spent Acids	SW 206	50,563.34	3.6433
8	Emulsi minyak mineral-air terpakai / Spent mineral oil-water emulsion	SW 307	35,551.00	2.5616
9	Buangan pelarut organik bukan terhalogen / Waste of Non-Halogenated Solvent	SW 322	34,390.16	2.4779
10	Buangan getah atau lateks yang mengandungi logam berat / Rubber/ Latex Waste Containing Heavy Metal	SW 321	28,066.75	2.0223
11	Enap cemar mineral / Mineral Sludge	SW 427	21,811.41	1.5712
12	Campuran buangan terjadual dan buangan tidak terjadual / Mixture of Scheduled Waste & Non-Scheduled Waste	SW 422	19,967.23	1.4387
13	Campuran buangan terjadual / Mixture of Scheduled Waste	SW 421	19,083.09	1.3750
14	Buangan patogenik / klinikal / Pathogenic / Clinical Waste	SW 404	18,152.95	1.3080
15	Sisa dari pengolahan atau pemerolehan kembali buangan terjadual / Residue From Recovery of Scheduled Waste	SW 501	16,807.26	1.2110
16	Enap cemar dakwat dan cat / Ink & Paints Sludge	SW 416	15,233.83	1.0977
17	Buangan dakwat dan cat / Waste of Inks & Paints	SW 417	14,513.62	1.0458
18	Kain buruk, plastik, kertas atau turas tercemar Rags / Plastics / Papers contaminated with Scheduled Waste	SW 410	13,429.22	0.9676
19	Produk dakwat, cat, pigmen atau lakuer yang tidak mengikut spesifikasi yang mengandungi pelarut organik / Discarded of Ink/Paint/ Pigment/Lacquer Containing Organic Solvent	SW 418	8,117.06	0.5849

Jadual 6.3 Malaysia : Jumlah Buangan Terjadual Yang Dihasilkan Mengikut Kod Buangan Terjadual, 2013

Table 6.3 Malaysia: Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2013

20	Buangan kimia / Lab Waste	SW 429	7,338.01	0.5287
21	Buangan minyak atau enap cemar berminyak / Waste oil / Oily sludge	SW 311	5,277.57	0.3803
22	Enap cemar yang mengandungi fluorida / Sludge Containing Fluoride	SW 207	5,277.52	0.3803
23	Buangan mangkin / Waste Catalyst	SW 202	4,818.20	0.3472
24	Minyak hidraulik terpakai / Spent Hydraulic oil	SW 306	4,641.05	0.3344
25	Buangan cecair terma / Waste Of Thermal Fluids	SW 327	3,520.16	0.2536
26	Diisosianat terpakai / Spent di-isocyanates	SW 419	3,146.78	0.2267
27	Buangan mengandungi merkuri / Waste containing Mercury	SW 109	2,986.31	0.2152
28	Alkali terpakai / Spent Alkalis	SW 401	2,397.45	0.1727
29	Alkali terpakai dengan pH ≥ 11.5 / Spent Alkalis With PH > 11.5	SW 402	2,356.11	0.1698
30	Tanah/puing tercemar / Contaminated Land/Soil	SW 408	2,303.60	0.1660
31	Klinker, sanga dan abu dari penunu buangan terjadual / Clinker/Slag/Ashes From Incinerator	SW 406	2,231.85	0.1608
32	Buangan pelarut organik terhalogen / Waste Of Halogenated Solvents	SW 323	2,208.63	0.1591
33	Enap cemar asid / Acid Sludge	SW 316	2,066.05	0.1489
34	Buangan resin yang mengandungi pelarut organik / Waste of Resin Containing Organic	SW 325	1,965.74	0.1416
35	Asid organik terpakai / Spent Organic Acids	SW 301	1,922.64	0.1385
36	Buangan bateri asid plumbum / Waste of lead acid batteries	SW 102	1,645.70	0.1186
37	Dadah terbuang / Expired Drug	SW 403	1,470.14	0.1059
38	Sisa berminyak dari bengkel automotif / Oily Residue from Workshop	SW 312	1,299.17	0.0936
39	Buangan fotografi / Photographic Waste	SW 423	1,220.84	0.0880
40	Buangan bateri yang mengandungi cadmium dan nikel / Waste Of Batteries Containing Cadmium/ Hg/ Lithium	SW 103	1,120.03	0.0807
41	Campuran minyak-air / Oil -Water mixture	SW 309	1,078.61	0.0777
42	Karbon teraktif terpakai / Contaminated Active Carbon	SW 411	1,036.77	0.0747
43	Minyak/Enapcemar daripada loji penapisan minyak / Oil Sludge from Oil Refinery	SW 314	935.81	0.0674
44	Buangan makmal / Chemical Waste	SW 430	706.01	0.0509

Jadual 6.3 Malaysia : Jumlah Buangan Terjadual Yang Dihasilkan Mengikut Kod Buangan Terjadual, 2013

Table 6.3 Malaysia: Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2013

45	Enap cemar dari tangki penyimpanan minyak mineral / Sludge from mineral oil storage tank	SW 310	615.56	0.0444
46	Buangan mengandungi formaldehid / Waste Containing Formaldehyde	SW 320	573.67	0.0413
47	Tar atau sisa bertar dari loji penapisan minyak / Tar Residue From Oil Refinery / Petrochemical Plant	SW 315	540.80	0.0390
48	Buangan fenol / Waste Of Phenols Its Compound	SW 319	463.44	0.0334
49	Buangan pelekat / glu yang mengandungi pelarut organik / Adhesive / Glue Containing Organic Solvent	SW 303	442.57	0.0319
50	Larutan alkali berair terpakai yang mengandungi sianida / Spent Aqueous alkaline Containing Cyanide	SW 414	207.50	0.0150
51	Tanah yang dicemari dengan minyak daripada penapisan semula minyak pelincir terpakai / Contaminated Oil from re-refining \ used lubricating Oil	SW 313	200.49	0.0144
52	Enap cemar yang distabilkan / Stabilized Sludge	SW 203	139.45	0.0100
53	Buangan sisa penyulingan tidak berair terhalogen atau bukan terhalogen / Waste both Halogenated or Non Halogenated From Recovery	SW 324	126.14	0.0091
54	Buangan farmaseutikal / Discarded Drug	SW 405	120.36	0.0087
55	Buangan asbestos / Asbestos	SW 201	102.85	0.0074
56	Buangan racun perosak / Pesticide	SW 425	80.52	0.0058
57	Buangan fluks / Flux Waste	SW 302	68.75	0.0050
58	Buangan sebatian fosforus organik / Waste of Organic phosphorus compound	SW 326	18.50	0.0013
59	Buangan dari pengilangan bahan letupan / Waste From Manufacturing / Processing or use of explosive	SW 431	17.26	0.0012
60	Sisa dari pemerolehan kembali likuor penjerukan asid / Residue from Recovery of Acid Pickling Liquor	SW 106	16.01	0.0012
61	Produk racun perosak yang tidak mengikut spesifikasi / Used Pesticide / Herbicides /Biocides	SW 426	11.34	0.0008
62	Enap cemar yang mengandungi sianida / Sludges Contaning Cyanide	SW 412	8.06	0.0006
63	Buangan yang mengandungi peroksida / Waste Containing Peroxides	SW 432	7.89	0.0006
64	Sanga kuprum / Slag of Copper	SW 107	3.88	0.0003

Jadual 6.3 Malaysia : Jumlah Buangan Terjadual Yang Dihasilkan Mengikut Kod Buangan Terjadual, 2013

Table 6.3 Malaysia: Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2013

65	Buangan daripada operasi pengawetan kayu / Waste From Wood Containing Heavy Metals	SW 428	3.00	0.0002
66	Buangan yang mengandungi arsenik / Waste containing arsenic	SW 101	1.99	0.0001
67	Agen pengoksidaan terpakai / Spent Oxidizing Agent	SW 424	1.07	0.0001
68	Sebatian organologam terpakai / Spent Of Organometallic compound	SW 317	1.03	0.0001
69	Garam terpakai yang mengandungi sianida / Spent salt containing Cyanide	SW 413	0.56	0.0000
70	Sisa dari pemprosesan zink / Zink Residue	SW 108	0.11	0.0000
71	Buangan yang mengandungi BFT dan TFT / Waste containing PCB or PCT	SW 318	0.08	0.0000
		Total	**1,387,861.64**	**100.00**

Jadual 6.3 Malaysia : Jumlah Buangan Terjadual Yang Dihasilkan Mengikut Kod Buangan Terjadual, 2013

Table 6.3 Malaysia: Quantity of Scheduled Wastes Generated by Scheduled Waste Code, 2013

No	Jenis Industri / Name of Waste	Jumlah Buangan / Quantity of Waste	
		(MT/Year / Tahun)	Peratus / Percentage (%)
1	Kemudahan Pemerolehan Kembali / Recovery Facilities	502,556.51	36.21
2	Elektrik Dan Elektronik / Electrical And Electronic	173,555.38	12.51
3	Industri Kimia / Chemical Industry	162,781.28	11.73
4	Pengilangan Logam / Metal Refinery	83,518.84	6.02
5	Kenderaan / Vehicle	64,090.40	4.62
6	Loji Janakuasa / Power Plant	50,765.10	3.66
7	Fabrikasi Logam / Metal Fabrication	47,871.54	3.45
8	Bengkel / Workshop	41,203.87	2.97
9	Berasaskan Getah / Rubber Base	38,584.28	2.78
10	Penyudahan Logam Dan Sadur Elektrik / Metal Finishing and Coating	35,155.35	2.53
11	Penapisan Petroleum / Petroleum Refinery	34,305.35	2.47
12	Percetakan / Printing	31,704.96	2.28

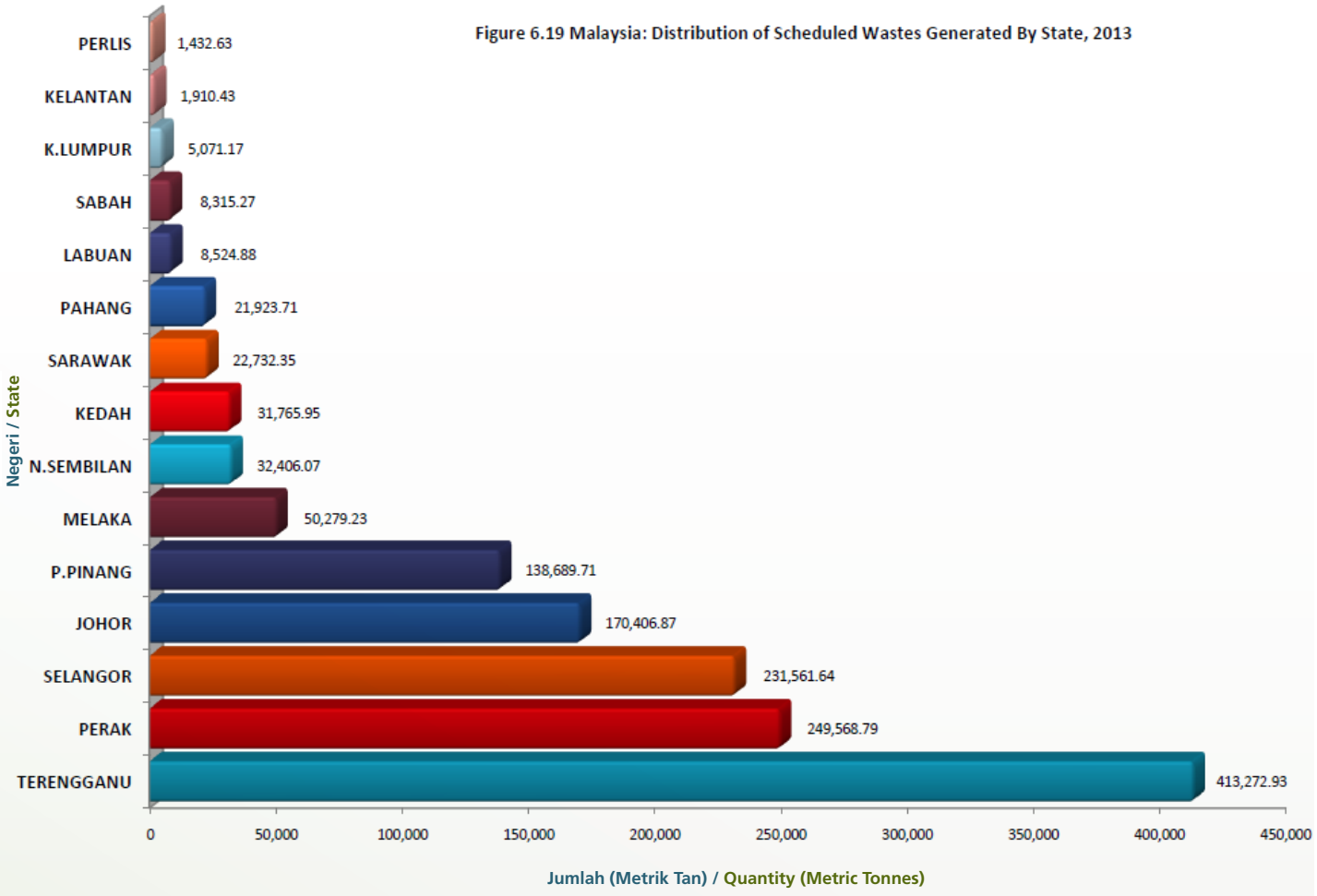
Table 6.4 Malaysia: Quantity of Scheduled Wastes Generated by Industry, 2013

Jadual 6.4 Malaysia : Jumlah Buangan Terjadual Yang Dihasilkan Mengikut Jenis Industri, 2013

13	Kertas / Paper	25,816.43	1.86
14	Perubatan / Health Care Services	18,206.68	1.31
15	Plastik / Plastic	12,162.64	0.88
16	Jentera / Machinery	11,523.44	0.83
17	Galian Bukan Logam / Non Metallic Mineral	11,045.76	0.80
18	Makanan & Minuman / Food & Drink	9,411.04	0.68
19	Penapisan Minyak Makan / Edible Oil Refinery	8,425.78	0.61
20	Berasaskan Kayu / Wood Base	7,520.46	0.54
21	Lain-lain / Others	4,564.81	0.33
22	Tekstil / Textiles	2,933.90	0.21
23	Kilang Kelapa Sawit (PYDT) / Palm Oil Mill	2,091.90	0.15
24	Perlombongan / Mining	2,024.69	0.15
25	Gudang / Warehouse	2,009.89	0.14
26	Simen / Cement	1,049.88	0.08
27	Kilang Getah (PYDT) / Rubber Factory	772.92	0.06
28	Loji Pengolahan Kumbahan Persendirian / Waste Water Treatment Plant	587.68	0.04
29	Kulit / Leather	434.01	0.03
30	Rokok Dan Tembakau / Cigarettes and Tobacco	379.22	0.03
31	Peralatan Pejabat dan Alat Tulis / Office Supplies and Stationery	305.05	0.02
32	Kuari / Quarry	218.71	0.02
33	Peralatan Sukan Dan Permainan / Sports Equipment and Games	189.42	0.01
34	Perkhidmatan / Services	94.45	0.01
	TOTAL	**1,387,861.64**	**100.00**

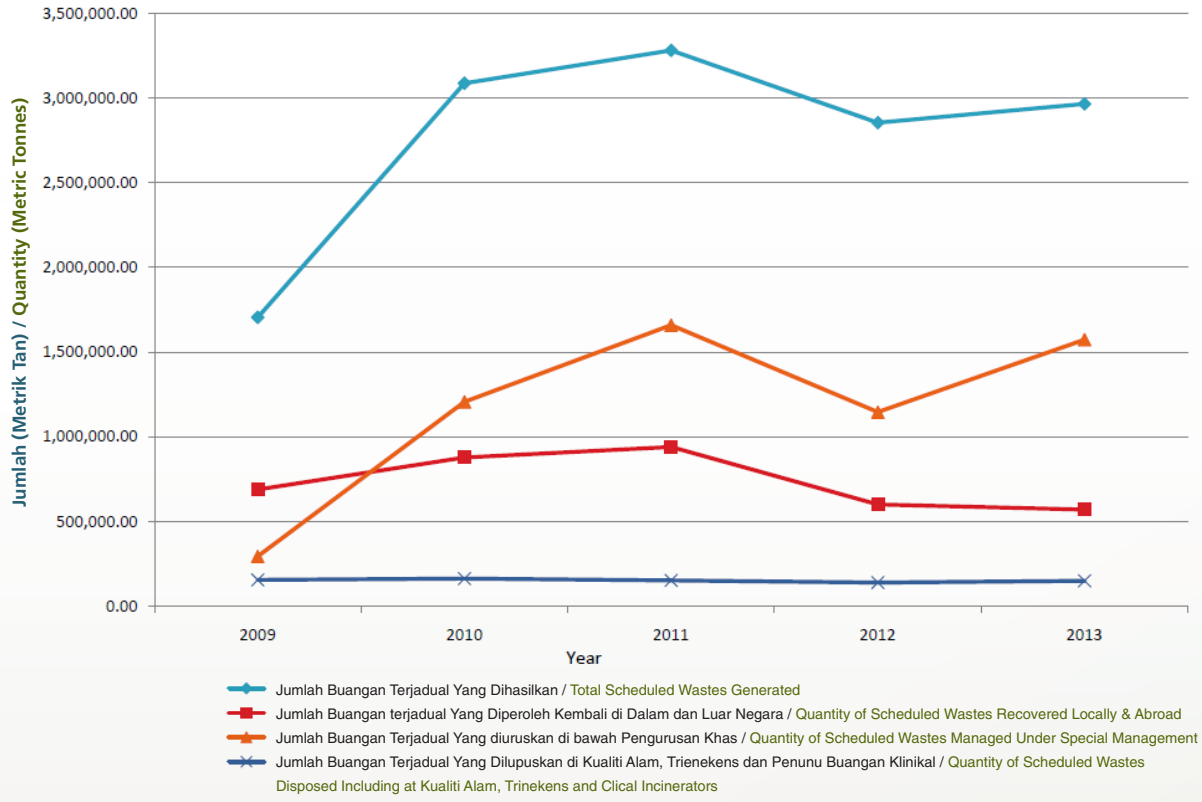
Table 6.4 Malaysia: Quantity of Scheduled Wastes Generated by Industry, 2013

Jadual 6.4 Malaysia : Jumlah Buangan Terjadual Yang Dihasilkan Mengikut Jenis Industri, 2013



Rajah 6.16 Malaysia: Penghasilan Buangan Terjadual mengikut negeri, 2013

Figure 6.16 Malaysia: Distribution of Scheduled Wastes Generated By State, 2013



Rajah 6.17 Malaysia: Trend Pengurusan Buangan Terjadual, 2009 - 2013

Figure 6.17 Malaysia: Trend of Scheduled Wastes Management, 2009 - 2013

No	Kemudahan / Facility	Metrik Tan / Tonnes	Peratusan / Percentage (%)
1	Pengurusan Khas / Special Waste Management	1,574,041.95	53.08
2	Pengolahan DalamTapak / On-Site Treatment	630,221.40	21.25
3	Kemudahan Pemerolehan Kembali Luar Tapak Tempatan / Local Off-site Recovery Facilities	566,506.51	19.10
4	Kualiti Alam Sdn Bhd / Kualiti Alam Sdn Bhd	111,860.20	3.77
5	Penstoran Dalam Tapak / On-Site Storage	41,742.48	1.41
6	Trienekens (Sarawak) Sdn Bhd / Trienekens (Sarawak) Sdn Bhd	19,330.00	0.65
7	Penunu Buangan Klinikal Off-site Clinical Waste Incinerators	18,201.05	0.61
8	Kemudahan Luar Negara (Export) / Foreign Facilities (Export)	3,708.07	0.13
	TOTAL	**2,965,611.65**	**100.00**

Jadual 6.5 Malaysia: Kemudahan Yang Mengendalikan Buangan Terjadual, 2013

Table 6.5 Malaysia: Facilities Handling Scheduled Wastes, 2013

No.	Kategori Buangan / Waste Category	Kod Buangan / Waste Code	Sumber / Source	Metrik Tan / Tonnes	Peratus / Percent (%)	Kaedah Pelupusan / Method of Disposal
1	Enap cemar Logam Berat / Heavy Metal Sludge	SW 204	Loji Rawatan Air Minuman / Drinking Water Treatment Plant	491,902.87	31.25	Tapak Pelupusan Sanitari / Sanitary Landfill
			Industri / Industry	107,958.53	6.86	
2	'Fly Ash' & 'Bottom Ash' / Fly Ash & Bottom Ash	SW 104	Loji Janakuasa elektrik / Coal-Fired Power Plant	867,358.18	55.10	Guna semula sebagai bahan mentah pembuatan produk /Reuse as raw material for product
			Industri / Industry	17,496.16	1.11	
3	Gipsum / Gypsum	SW 205	Industri / Industry	81,382.97	5.17	Tapak Pelupusan Sanitari / Sanitary landfill
4	Glu / Glue	SW 303	Industri / Industry	0	0.00	Guna semula sebagai bahan mentah pembuatan produk /Reuse as raw material for product
5	Produk sampingan Petroleum / Petroleum By Product	SW 322	Industri / Industry	121.93	0.01	Diperolehi kembali Recovered
6	Buangan yang mengandungi formaldehid, resin, serbuk epoksi terbuang / Waste Containing Formaldehyde, resin, discarded epoxy powder	SW 320, 325, 418	Industri / Industry	4,475.14	0.28	Tapak Pelupusan Sanitari / Sanitary landfill
7	Produk farmasi terbuang, Produk terbuang / Discarded Pharmaceutical Product, Discarded Product	SW 405, 429	Industri / Industry	60.757	0.00	Tapak Pelupusan Sanitari / Sanitary landfill
8	Abu dari enapcemar kertas / Ash of Paper Sludge	SW 406	Industri / Industry	3,277.01	0.21	Tapak Pelupusan Sanitari / Sanitary landfill
9	Campuran minyak terpakai / Spent Mixed Oil	SW 421	Industry	8.4	0.00	Guna semula sebagai agen 'releasing' untuk acuan simen/ Reuse as rel easing agent for mould cement
TOTAL				**1,574,041.95**	**100.00**	

Table 6.6 Malaysia: Generated Scheduled Waste Managed Under Special Management, 2013

Jadual 6.6 Malaysia: Buangan Terjadual Yang Diuruskan Di Bawah Pengurusan Khas

Sebanyak 445 kemudahan pemerolehan kembali luar tapak telah dilesenkan oleh Jabatan ini untuk pemerolehan kembali pelbagai kategori buangan terjadual. Kemudahan yang paling banyak dilesenkan mengikut kategori buangan terjadual adalah buangan elektrik dan elektronik (150 kemudahan) diikuti dengan enapcemar minyak / mineral / agen penyejuk terpakai (56 kemudahan), dross / abu / sanga / pemangkin (62 kemudahan), enapcemar logam berat / getah (47 kemudahan), bekas terpakai / Buangan yang tercemar / dakwat / cat / lakuer (34 kemudahan), pelarut (31 kemudahan) dan asid / alkali (17 kemudahan), manakala empat (4) kategori buangan terjadual yang lain berjumlah 48 kemudahan seperti di **Jadual 6.7.**

A total of 445 off-site recovery facilities have been licensed by the department to recover various categories of scheduled wastes. The most licensed facilities according to categories of waste are electronic and electrical wastes (150 facilities) followed by oil/ mineral sludge/spent coolant (56 facilities), dross/ ash/ slag/ catalyst (62 facilities), heavy metal sludge/ rubber (47 facilities), used container/ contaminated waste/ ink/ paint/ lacquer (34 facilities), solvent (31 facilities) and acid/ alkaline (17 facilities), whilst four (4) other wastes categories totaling of 48 facilities as shown in **Table 6.7**.

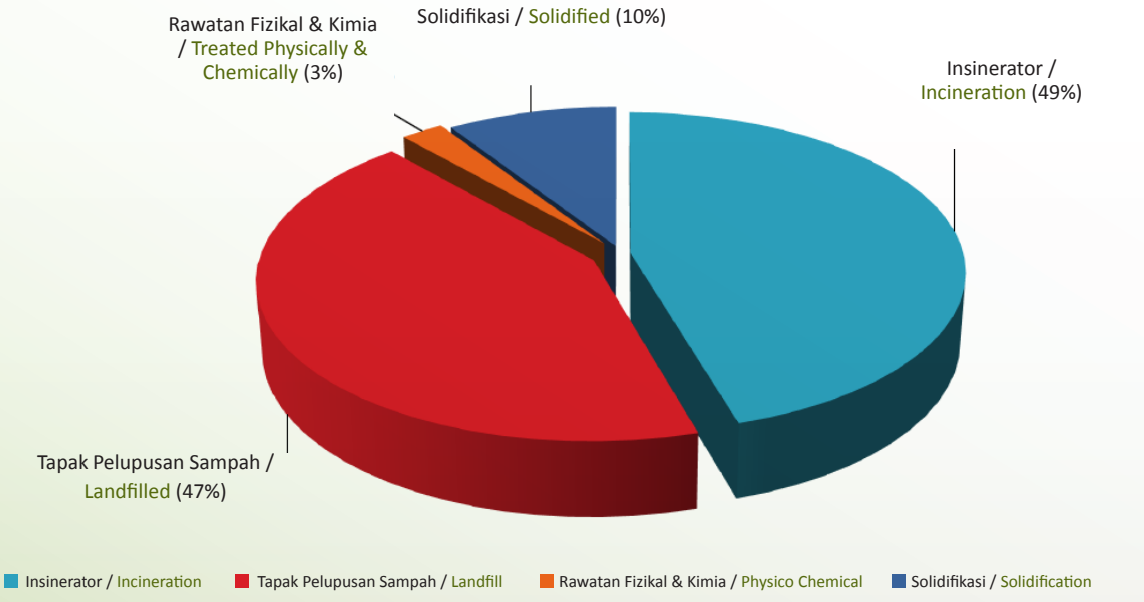
Kategori Buangan / Waste Category	Recovery Facility
Buangan elektrik dan elektronik / Electronic and Electrical Wastes	150
Minyak / Enap cemar Mineral / Agen Penyejuk Terpakai Oil / Mineral Sludge / Spent Coolant	56
Dros / Abu / Sanga / Pemangkin / Dross / Ash / Slag / Catalyst	62
Enap cemar logam berat / Getah / Heavy Metal Sludge / Rubber	47
Bekas terpakai / Buangan tercemar / Dakwat / Cat / Lakuer / Used Container / Contaminated Waste / Ink / Paint /Lacquer	34
Pelarut / Solvent	31
Asid / Alkali / Acid / Alkaline	17
Fenol / Pelekat / Resin / Phenol / Adhesive / Resin	23
Fotografi / Photographic	12
Bateri / Battery	6
Gipsum / Gypsum	7
TOTAL	**445**

Jadual 6.7 Malaysia: Bilangan Kemudahan Pemerolehan Kembali Luar Tapak, 2013

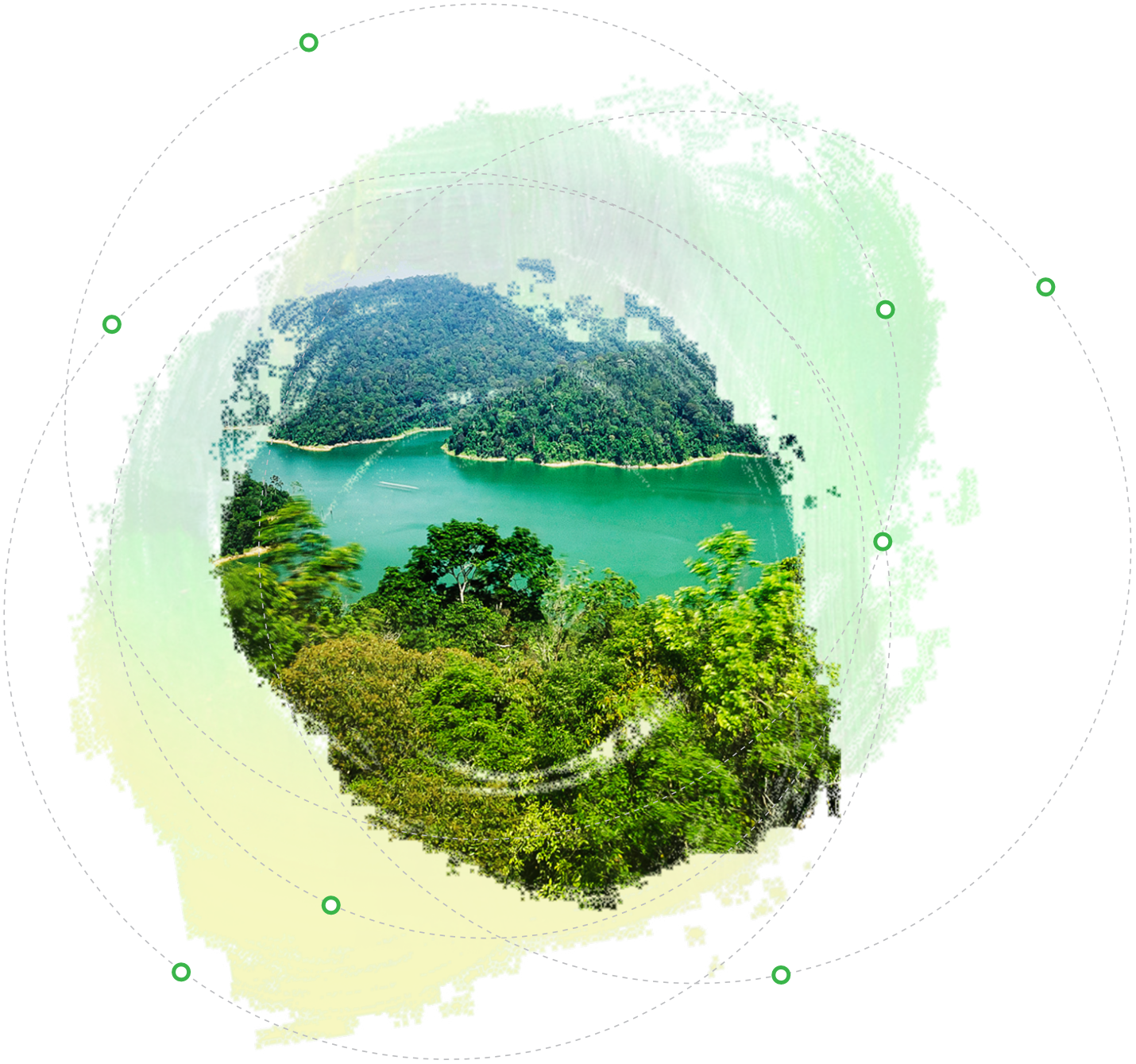
Table 6.7 Malaysia: Numbers of Off-site Recovery Facilities, 2013

Kategori buangan terjadual yang dihantar ke premis berlesen (Kualiti Alam Sdn Bhd dan Trinekens (Sarawak) Sdn Bhd) untuk pelupusan akhir adalah seperti enapcemar yang mengandungi satu atau beberapa logam berat, campuran buangan terjadual, debu / sanga / dros atau abu yang mengandungi arsenik / merkuri dan asid bukan organik terpakai. Buangan tersebut sama ada dibakar, dirawat secara fizikal dan kimia, distabilkan atau dilupuskan di tapak pelupusan selamat bergantung kepada ciri-ciri tertentu. Seperti yang ditunjukkan dalam **Rajah 6.18**, kebanyakan sisa dihantar ke Kualiti Alam Sdn Bhd dan Trienekens Sdn Bhd adalah dibakar (49%), diikuti ke tapak pelupusan (47%), solidifikasi (10%) dan rawatan secara fizikal dan kimia (3%).

The categories of wastes sent to the licensed premises (Kualiti Alam Sdn Bhd and Trinekens (Sarawak) Sdn Bhd) for final disposal are sludge containing one or several heavy metals, mixed wastes, dust/slag/ dross or ash containing arsenic/ mercury and spent inorganic acid. Such wastes were either incinerated, treated physically and chemically, solidified or disposed off in secured landfill depending on their characteristics. As shown in **Figure 6.18,** most wastes sent to Kualiti Alam Sdn Bhd and Trienekens Sdn Bhd were incinerated (49%), followed by landfilled (47%), solidified (10%) and treated physically and chemically (3%).



Rajah 6.18 Kualiti Alam and Trienekens: Jenis Rawatan dan Pelupusan Buangan Terjadual, 2013
Figure 6.18 Types of Treatment and Disposal of Waste, 2013



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

Notes :

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

NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

PARAMETER	UNIT	CLASS					
		I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/l	0.1	0.3	0.3	0.9	2.7	> 2.7
Biochemical Oxygen Demand	mg/l	1	3	3	6	12	> 12
Chemical Oxygen Demand	mg/l	10	25	25	50	100	> 100
Dissolved Oxygen	mg/l	7	5 - 7	5 - 7	3 - 5	< 3	< 1
pH	-	6.5 - 8.5	6 - 9	6 - 9	5 - 9	5 - 9	-
Colour	TCU	15	150	150	-	-	-
Electrical Conductivity*	S/cm	1000	1000	-	-	6000	-
Floatables	-	N	N	N	-	-	-
Odour	-	N	N	N	-	-	-
Salinity	%	0.5	1	-	-	2	-
Taste	-	N	N	N	-	-	-
Total Dissolved Solid	mg/l	500	1000	-	-	4000	-
Total Suspended Solid	mg/l	25	50	50	150	300	300
Temperature	°C	-	Normal + 2 °C	-	Normal + 2 °C	-	-
Turbidity	NTU	5	50	50	-	-	-
Faecal Coliform**	count/100 ml	10	100	400	5000 (20000)[a]	5000 (20000)[a]	-
Total Coliform	count/100 ml	100	5000	5000	50000	50000	> 50000

Notes :

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

WATER CLASSES AND USES

CLASS	USES
Class I	Conservation of natural environment. Water Supply I – Practically no treatment necessary. Fishery I – Very sensitive aquatic species.
Class IIA	Water Supply II – Conventional treatment required. Fishery II – Sensitive aquatic species.
Class IIB	Recreational use with body contact.
Class III	Water Supply III – Extensive treatment required. Fishery III – Common, of economic value and tolerant species; livestock drinking.
Class IV	Irrigation
Class V	None of the above.

DOE WATER QUALITY CLASSIFICATION BASED ON WATER QUALITY INDEX

SUB INDEX & WATER QUALITY INDEX	INDEX RANGE		
	CLEAN	SLIGHTLY POLLUTED	POLLUTED
Biochemical Oxygen Demand (BOD)	91 - 100	80 - 90	0 - 79
Ammoniacal Nitrogen (NH_3-N)	92 - 100	71 - 91	0 - 70
Suspended Solids (SS)	76 - 100	70 - 75	0 - 69
Water Quality Index (WQI)	81 - 100	60 - 80	0 - 59

DOE WATER QUALITY INDEX CLASSIFICATION

PARAMETER	UNIT	CLASS				
		I	II	III	IV	V
Ammoniacal Nitrogen	mg/l	< 0.1	0.1 – 0.3	0.3 – 0.9	0.9 – 2.7	> 2.7
Biochemical Oxygen Demand	mg/l	< 1	1 – 3	3 – 6	6 – 12	> 12
Chemical Oxygen Demand	mg/l	< 10	10 – 25	25 – 50	50 – 100	> 100
Dissolved Oxygen	mg/l	> 7	5 – 7	3 – 5	1 – 3	< 1
pH	-	> 7.0	6.0 – 7.0	5.0 – 6.0	< 5.0	> 5.0
Total Suspended Solid	mg/l	< 25	25 – 50	50 – 150	150 – 300	> 300
Water Quality Index (WQI)		> 92.7	76.5 – 92.7	51.9 – 76.5	31.0 – 51.9	< 31.0

WQI FORMULA AND CALCULATION

FORMULA

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

where;

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

BEST FIT EQUATIONS FOR THE ESTIMATION OF VARIOUS SUBINDEX VALUES

Subindex for DO (in % saturation)

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

Subindex for BOD

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

Subindex for COD

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

Subindex for NH3-N

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

Subindex for SS

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

Subindex for pH

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

Note: * means multiply with

MWQI FORMULA AND CALCULATION

$MWQI = SI\ DO^{0.2} \times SI\ NH_3^{0.16} \times SI\ FC^{0.14} \times SI\ TSS^{0.14} \times SI\ O\&G^{0.13} \times SI\ NO_3^{0.12} \times SI\ PO_4^{0.11}$

where;

SIDO = Subindex Dissolved Oxygen
SINH3 = 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

$0 \leq MWQI \geq 100$

BEST FIT EQUATIONS FOR THE ESTIMATION OF VARIOUS SUBINDEX VALUES

Dissolved Oxygen (DO) in mg/L

For DO between 3 and 7

$SI(DO) = -85.816 + 55.476(DO) - 4.142(DO)^2$

If DO is less than 3, or more than 10, SI = 10%

Ammonia (Unionized) (NH_3) in mg-N/L*

$SI(NH_3) = 100exp\text{-}4.6(NH_3)$

** If Ammoniacal Nitrogen (NH_3+-N) is measured, convert the value into unionized ammonia.*

Faecal Coliform (FC) in MPN/100ml

$SI(FC) = 100exp^{-0.005(FC)}$

If FC ≥ 500 MPN, SI = 8%

Total Suspended Solids (TSS in mg/L)

$SI(TSS) = 95.8exp^{-0.0043(TSS)}$

If TSS > 100 mg/L, SI = 20%

Oil & Grease (OG) in mg/L

SI(OG) = 98exp-0.21(OG)

Nitrate (NO_3) in mg-N/L

$SI(NO_3) = 94.83exp^{-0.35(NO3)}$

Phosphate (PO_4) in mg-P/L

$SI(PO_4) = 95.2exp^{-0.002(PO4*1000)}$

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

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

d. Calculation of mole fraction for unionized ammonia

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

Equation:

Unionized ammonia = Total ammoniacal nitrogen x mole fraction

Total ammoniacal nitrogen should be measured in µg/l