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Kualiti Air Tanah
Groundwater Quality

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PENGAWASAN KUALITI AIR TANAH

Program Pengawasan Kualiti Air Tanah Kebangsaan telah dimulakan pada tahun 1997 dan pada masa ini program pengawasan telah dijalankan di 78 telaga pengawasan di Semenanjung Malaysia, 12 telaga di Sarawak dan 15 telaga di Sabah (**Jadual 3.1**). Telaga-telaga yang telah dibina adalah mewakili 12 jenis guna tanah seperti pertanian, bandar / pinggir bandar, luar bandar dan industri, tapak pelupusan sampah, padang golf, kawasan pelupusan bangkai haiwan, bekalan air tempatan, bekas lombong emas dan lain-lain.

Pada tahun 2016, sebanyak 381 sampel telah diambil daripada telaga-telaga pengawasan ini dan telah dianalisa untuk parameter bahan kimia organik meruap (VOCs), racun perosak, logam berat, anion, bakteria (koliform), sebatian berfenol, jumlah keliatan, jumlah pepejal terlarut, pH, suhu, konduktiviti dan oksigen terlarut (DO).

Keputusan analisis telah dibandingkan dengan Garis Panduan Kebangsaan Bagi Kualiti Air untuk Minuman yang telah dibangunkan oleh Kementerian Kesihatan (Semakan Disember 2000) (**Jadual 3.2**) bagi menentukan status kualiti air tanah memandangkan Jabatan Alam Sekitar masih lagi belum membangunkan standard dan kriteria air tanah kebangsaan.

GROUNDWATER QUALITY MONITORING

The National Groundwater Monitoring Programme was established since 1997 and presently monitoring programme is being carried out at 78 wells in Peninsular Malaysia, 12 wells in Sarawak and 15 wells in Sabah (**Table 3.1**). Monitoring well 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 2016, 381 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).

The results has been compared with the National Guidelines for Drinking Water Quality established by the Ministry of Health (Revised December 2000) (**Table 3.2**) to determine the status of the quality of groundwater. Currently, groundwater standard and criteria by Department of Environment is not yet established.

Jadual 3.1 Malaysia: Bilangan Telaga Air Tanah Mengikut Jenis Kategori Guna Tanah, 2016
 Table 3.1 Malaysia : Number of groundwater wells by land use category, 2016

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 3.2 Malaysia: Garis Panduan Kebangsaan Bagi Kualiti Air Untuk Minuman (Semakan Disember 2000)
 Table 3.2 Malaysia : National Guidelines for Drinking Water Quality (Revised December 2000)

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
Koliform/ Total Coliform	—	MPN/100ml	Mesti tidak dikesan dalam sebarang 100ml sampel Must not be detected in any 100 ml 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

Sumber : Kementerian Kesihatan Malaysia (Tahun 2000) Source : Ministry of Health, Malaysia (2000)

STATUS KUALITI AIR TANAH

Penilaian kualiti air tanah adalah berdasarkan kepada nilai peratusan yang melebihi had piawai dalam Garis Panduan Kebangsaan bagi Kualiti Air untuk Minuman, 2000 (NGDWQ). Peratusan julat dibahagikan kepada tiga kategori iaitu antara 0% to 49% sebagai "rendah"; 50 - 79% sebagai "sederhana"; dan 80 - 100% sebagai "tinggi".

Pada tahun 2016, keputusan analisis sampel daripada pengawasan yang dijalankan menunjukkan bahawa semua stesen berada dalam julat nilai pematuhan NGDWQ kecuali bagi parameter arsenik (As), besi (Fe), mangan (Mn), jumlah kolifom dan juga fenol (**Rajah 3.1**).

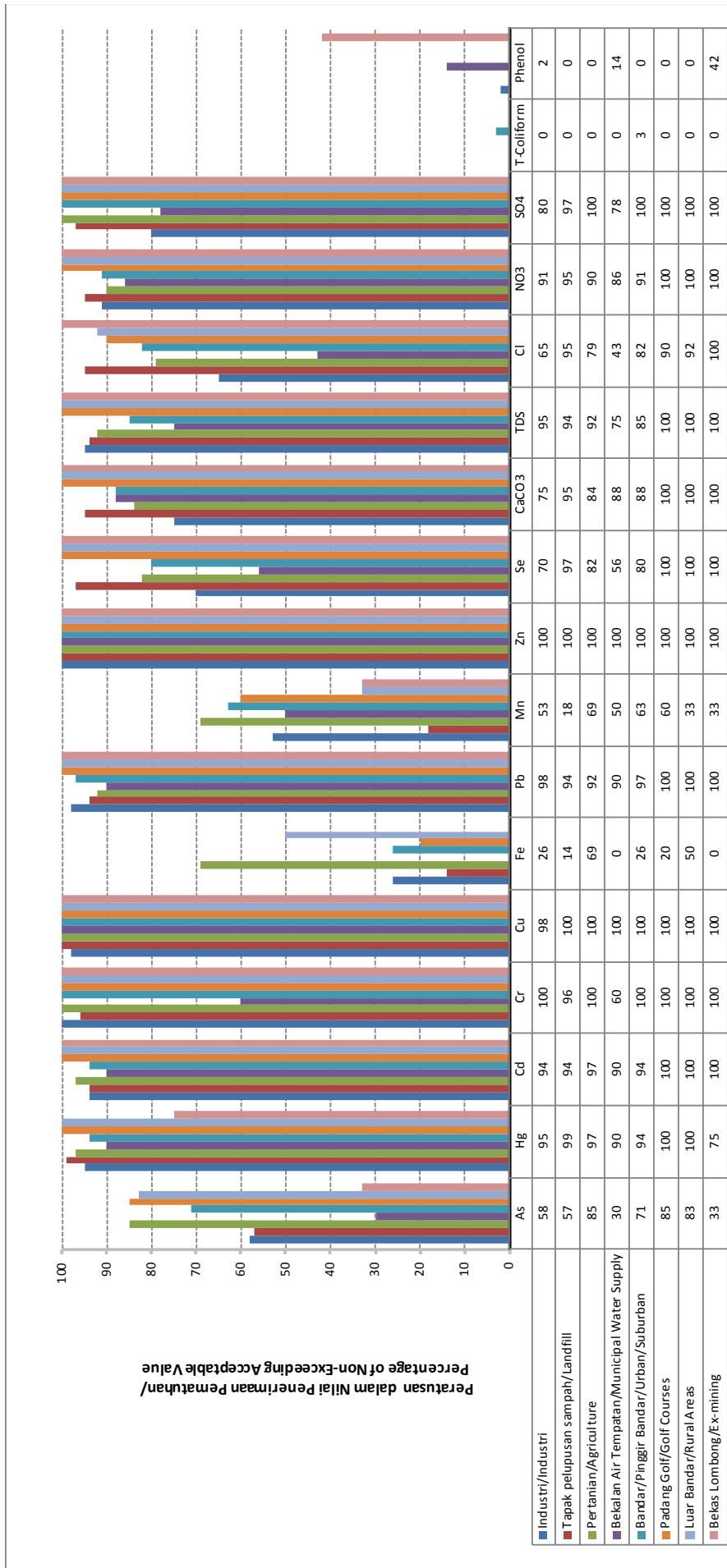
Parameter jumlah kolifom, fenol, Fe, Mn dan As didapati melebihi nilai pematuhan garis panduan **Jadual 3.3** menunjukkan peratusan sample yang melebihi nilai NGDWQ.

GROUNDWATER QUALITY STATUS

Assessment of groundwater quality was also conducted based on the percentage of samples exceeding the National Guidelines for Drinking Water Quality 2000 (NGDWQ). The range of 0% - 49% was categorized as 'low', 50% - 79% as 'moderate' and 80% - 100% as 'high'.

In 2016, from the monitoring results it was found that all stations were within the NGDWQ values except for arsenic (As), iron (Fe), manganese (Mn), total coliform and phenol (**Figure 3.1**).

Total coliform, phenol, Fe, Mn and As recorded exceeding the guideline values. **Table 3.3** shows the percentage of sample exceeding the NGDWQ.



Rajah 3.1 Malaysia : Peratusan Pematuhan oleh Pencemar Terpilih Mengikut Guna Tanah, 2016
 Figure 3.1 Malaysia : Percentage of Compliance of Selected Contaminants by Land Use, 2016

Jadual 3.3 Malaysia : Peratusan yang melebihi NGDWQ mengikut Negeri, 2016
 Table 3.3 Malaysia : Percentage of Exceedance NGDWQ by State, 2016

Negeri / State	Bilangan Stesen / No. of Station	Maklumat Stesen / Station Description	Nilai Peratusan yang Melebihi NGDWQ (%) / The Percentage of Exceedance NGDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Sabah	14	1) ITAC, Penampang 1	0	100	100	100	100
		2) ITAC, Penampang 2	67	100	100	100	100
		3) ITAC, Penampang 3	0	100	100	100	100
		4) ITAC, Penampang 4	0	100	100	100	100
		5) ITAC, Penampang 5	34	100	100	100	100
		6) ITAC, Penampang 6	34	67	100	100	100
		7) ITAC, Penampang 7	100	100	100	100	100
		8) Limbawang	67	67	33	100	100
		9) Tawau	0	0	0	-	100
		10) Kg. Tajau Laut	50	100	50	100	100
		11) Sandakan Golf Club No.1	0	0	0	-	50
		12) Sandakan Golf Club No.2	0	0	0	-	50
		13) Inanam	100	100	50	-	100
		14) Pulau Manukan	67	100	100	100	100
Sarawak	12	1) Kemuyang no.1	0	100	100	100	100
		2) Kemuyang no.2	0	100	50	100	100
		3) Kabong	100	100	100	100	100
		4) Kuala Lawas no.1	0	100	0	100	100
		5) Kuala Lawas no.2	100	100	100	100	100
		6) Laku	100	100	0	100	-
		7) Kg. Lusut Kiri	100	100	0	100	-
		8) Bau no.1	100	100	100	100	75
		9) Bau no.2	100	100	100	100	50
		10) Bau	0	100	0	100	75
		11) Oya no.1	100	100	100	100	100
		12) Oya no.2	100	100	100	100	100
Terengganu	13	1) Kerteh no.1	25	25	0	100	100
		2) Kerteh no.2	0	100	25	100	100
		3) Telok Kalong no.1	0	100	0	100	100
		4) Telok Kalong no.2	0	100	100	100	100
		5) Kg. Kubang Badak no.1, K.Treg	0	0	0	100	100
		6) Kg. Kubang Badak no.2, K.Treg	0	100	0	100	100
		7) Kg. Merang,Setiu	0	0	0	100	100
		8) Kg. Raja no.1, Besut	25	75	25	100	100
		9) Kg. Raja no.2, Besut	0	75	75	100	100
		10) Bukit Payung, Marang	0	25	25	100	100
		11) Kg. Alor Peroi no.1	50	100	100	100	100
		12) Kg. Alor Peroi no.2	25	100	75	100	100
		13) Kg. Alor Peroi no.3	0	100	25	100	100
Kedah	4	1) Kulim Hi-tech	100	100	100	100	100
		2) Pulau Langkawi no.1	0	100	0	100	100
		3) Pulau Langkawi no.2	100	100	0	100	100
		4) Kepala Batas	0	100	0	100	100
Negeri Sembilan	3	1) Senawang	100	100	25	100	100
		2) Kualiti Alam Sdn. Bhd no.1	0	75	100	100	100
		3) Kualiti Alam Sdn. Bhd no.2	50	100	100	100	100

Jadual 3.3 Malaysia : Peratusan yang melebihi NGDWQ mengikut Negeri, 2016
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Negeri / State	Bilangan Stesen / No. of Station	Maklumat Stesen / Station Description	Nilai Peratusan yang Melebihi NGDWQ (%) / The Percentage of Exceedance NGDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Pahang	8	1) Nenasi	100	100	100	100	100
		2) Lepar	0	25	0	100	100
		3) Agrobrest no.2, Nenasi	25	0	0	100	100
		4) Agrobrest no.3, Nenasi	25	100	100	100	100
		5) Agrobrest no.4, Nenasi	25	100	50	100	100
		6) Agrobrest no.5, Nenasi	25	100	25	100	100
		7) Agrobrest no.6, Nenasi	25	100	100	100	100
		8) Agrobrest no.7, Nenasi	25	100	100	100	100
Johor	6	1) Tg. Puteri, Pasir Gudang (MUCC)	0	67	0	100	100
		2) Tg. Puteri, Pasir Gudang	34	100	100	100	100
		3) Kota Tinggi	100	100	67	100	100
		4) Ulu Choh (Pintu)	100	100	100	100	100
		5) Ulu Choh (Kolam)	100	100	100	100	100
		6) Ulu Choh (Sungai)	100	100	100	100	100
Perlis	3	1) Arau no.1	0	50	75	100	100
		2) Arau no.2	0	75	25	100	100
		3) Padang Besar	0	25	0	100	100
Kelantan	15	1) Eastern Garment MFG no.1	75	75	75	100	100
		2) Eastern Garment MFG no.2	0	0	0	100	100
		3) Panji no.1	0	75	25	100	100
		4) Panji no.2	0	75	25	100	100
		5) Pasir Mas	0	100	100	100	100
		6) Kampong Jembal	0	100	75	100	100
		7) Beris Lalang	0	0	0	100	100
		8) Rantau Panjang no.1	0	100	0	100	100
		9) Rantau Panjang no.2	0	-	-	-	-
		12) Kelab Golf & Desa no.1	0	100	25	100	100
		13) Kelab Golf & Desa no.2	0	100	25	100	100
		10) Kelab Golf DiRaja Kubang Kerian no.1	100	100	100	100	100
		11) Kelab Golf DiRaja Kubang Kerian no.2	0	100	50	100	100
		14) Bachok no.1	0	25	75	100	100
		15) Bachok no.2	50	100	100	100	100
Melaka	1	1) Petronas Sungai Udang	75	75	100	100	100
Perak	3	1) Tambun	100	100	100	100	100
		3) Jalong no.2	0	100	100	67	100
		4) Batu Gajah	100	100	100	100	100
Kuala Lumpur	6	1) Jln. Sungai Besi no.1	100	100	100	100	100
		2) Jln. Sungai Besi no.2	100	100	100	100	100
		3) Jln. Sungai Besi no.3	100	34	100	100	100
		4) Taman Beringin no.1	100	67	67	100	100
		5) Taman Beringin no.2	100	100	100	100	100
		6) Royal Selangor Golf Club	-	-	-	-	-

Jadual 3.3 Malaysia : Peratusan yang melebihi NGDWQ mengikut Negeri, 2016
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Negeri / State	Bilangan Stesen / No. of Station	Maklumat Stesen / Station Description	Nilai Peratusan yang Melebihi NGDWQ (%) / The Percentage of Exceedance NGDWQ (%)				
			As	Fe	Mn	T-coliform	Phenol
Selangor	8	1) Sek Keb Seksyen 20, Shah Alam	25	100	25	100	100
		2) CIAST no.1, Shah Alam	25	100	100	100	100
		3) CIAST no.2, Shah Alam	100	100	100	100	100
		4) Saujana Golf Resort no.1, Subang	75	75	25	100	100
		5) Saujana Golf Resort no.2, Subang	25	25	0	100	100
		6) Rumah India, Sepang	75	100	100	100	100
		7) TNB Sepang	0	100	75	100	100
		8) Ladang Sepang	-	-	-	-	-
Pulau Pinang	6	1) Mak Mandin no.1	100	25	100	100	
		2) Mak Mandin no.2	100	50	75	100	100
		3) Bayan Lepas	50	50	25	100	100
		4) Valdor (Kelapa)	75	100	100	100	100
		5) Valdor (Tengah)	0	100	100	100	100
		6) Valdor (Jalan)	50	100	100	100	100
		1) Senawang	100	100	25	100	100