



JABATAN PERDANA MENTERI
JABATAN PERANGKAAN MALAYSIA

STATISTIK ALAM SEKITAR

ENVIRONMENT STATISTICS

PULAU PINANG 2021

Pemakluman / Announcement:

Jabatan Perangkaan Malaysia sedang menjalankan Survei Pendapatan, Perbelanjaan Isi Rumah dan Kemudahan Asas (HIES/BA) 2022 bermula dari 1 Januari 2022 sehingga 31 Disember 2022.

The Department of Statistics Malaysia is conducting the Household Income, Expenditure and Basic Amenities Survey (HIES/BA) 2022 from 1st January 2022 to 31st December 2022.

Dimaklumkan bahawa Kerajaan Malaysia telah mengisytiharkan Hari Statistik Negara (MyStats Day) pada 20 Oktober setiap tahun.

Tema sambutan MyStats Day adalah
"Connecting the World with Data We Can Trust"

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*MyStats Day theme is
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DEPARTMENT OF STATISTICS MALAYSIA

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Pengguna yang mengeluarkan sebarang maklumat dari terbitan ini sama ada yang asal atau diolah semula hendaklah meletakkan kenyataan berikut:

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KATA PENGANTAR

Statistik Alam Sekitar, 2021 memaparkan statistik alam sekitar negeri Pulau Pinang yang meliputi enam komponen iaitu Keadaan dan Kualiti Alam Sekitar; Sumber Alam Sekitar dan Kegunaannya; Sisa; Kejadian Ekstrem dan Bencana; Penempatan Penduduk dan Kesihatan Persekitaran; dan Penglibatan, Pengurusan dan Perlindungan Alam Sekitar. Penyusunan statistik ini meliputi maklumat dan keadaan alam sekitar, impak aktiviti manusia ke atas alam sekitar dan langkah yang diambil bagi mengurangkan impak tersebut.

Statistik alam sekitar ini boleh digunakan oleh agensi kerajaan negeri, sektor swasta, ahli akademik serta individu sebagai rujukan dalam menjalankan penyelidikan dan penganalisan di peringkat negeri. Rangka kerja yang digunakan dalam penerbitan ini adalah berdasarkan *Framework for the Development of Environment Statistics (FDES)*, *United Nations* 2013.

Penerbitan ini mengandungi enam bahagian. Bahagian pertama membentangkan infografik statistik alam sekitar, diikuti dengan ringkasan penemuan mengikut komponen di bahagian kedua serta kotak artikel di bahagian ketiga. Bahagian keempat pula memuatkan jadual terperinci mengenai statistik alam sekitar. Lampiran dan glosari disertakan di bahagian kelima dan keenam bagi membantu pengguna memahami statistik dan terma alam sekitar yang digunakan.

Jabatan merakamkan setinggi-tinggi penghargaan atas kerjasama dan sumbangan yang diberikan oleh semua pihak dalam menjayakan penerbitan ini. Setiap maklum balas dan cadangan untuk penambahbaikan penerbitan ini pada masa akan datang amatlah dihargai.

DATO' SRI DR. MOHD UZIR MAHIDIN

Ketua Perangkawan Malaysia

April 2022

PREFACE

Environment Statistics, 2021 presents the environment statistics of Pulau Pinang which covers six components namely Environmental Conditions and Quality; Environmental Resources and their Use; Residuals; Extreme Events and Disasters; Human Settlements and Environmental Health; and Environmental Protection, Management and Engagement. The compilation of these statistics includes environment state and information, impacts of human activities on the environment and actions taken to minimise the impact.

These environment statistics can be used by state government agencies, private sectors, academicians and individuals as a reference to conduct research and analysis at the state level. The framework used in this publication is based on the Framework for the Development of Environment Statistics (FDES) United Nations 2013.

This publication consists of six parts. The first part focused on the infographics of environment statistics, followed by a summary of findings by component in the second part with the articles box at the third part. The fourth part contains detailed tables on environment statistics. Appendices and glossary covered in the fifth and sixth parts are to facilitate users in understanding the statistics and environment terms used.

The Department gratefully acknowledges the co-operation and contribution rendered by all parties in making this publication a success. Every feedback and suggestion towards improving future publications is highly appreciated.

DATO' SRI DR. MOHD UZIR MAHIDIN

Chief Statistician, Malaysia

April 2022

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INFOGRAPHICS



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JABATAN PERDANA MENTERI
JABATAN PERANGKAAAN MALAYSIA



STATISTIK ALAM SEKITAR

PULAU PINANG



Keluasan tanah
(km²)

2021 >>> 1,049.07
2020 >>> 1,049.07



Penduduk ('000)

2021 >>> 1,774.4
2020 >>> 1,770.4



Kawasan berhutan
(hektar)

2018 >>> 7,752
2017 >>> 7,761



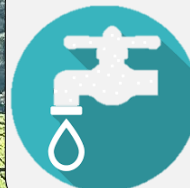
Buangan terjadual
(tan metrik)

2020 >>> 405,501
2019 >>> 326,884



Rekabentuk kapasiti
loji rawatan air (JLH)

2020 >>> 1,599
2019 >>> 1,599



Pengeluaran air
yang dibekalkan (JLH)

2020 >>> 1,108
2019 >>> 1,093



Buangan klinikal
(tan metrik)

2020 >>> 3,336.0
2019 >>> 2,360.3



Bekalan air mentah
diabstrak dari sungai
(JLH)

2020 >>> 1,297
2019 >>> 1,037



Bekalan air mentah diabstrak
dari empangan
(JLH)

2020 >>> 87
2019 >>> 84



Bekalan air mentah
diabstrak dari
air bawah tanah (JLH)

2020 >>> -
2019 >>> -



Kejadian
banjir

2020 >>> 28
2019 >>> 31



Hakisan
pantai (km)

2020 >>> 16.3
2019 >>> 16.3



Kemalangan
jalan raya

2020 >>> 35,234
2019 >>> 47,198



Bilangan
demam denggi (kes)

2020 >>> 1,039
2019 >>> 4,107



Kejadian
kebakaran (kes)

2020 >>> 2,758
2019 >>> 2,860

Nota:

JLH: Juta liter sehari e: anggaran p: awalan

Sumber: Statistik Alam Sekitar, Pulau Pinang, 2021
Jabatan Perangkaan Malaysia



ENVIRONMENT STATISTICS

PULAU PINANG



Land areas
(km²)

2021 >>> 1,049.07
2020 >>> 1,049.07



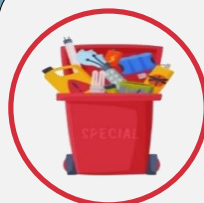
Population ('000)

2021 >>> 1,774.4
2020 >>> 1,770.4



Forested areas
(hectares)

2018 >>> 7,752
2017 >>> 7,761



Scheduled wastes
(metric tonnes)

2020 >>> 405,501
2019 >>> 326,884



Water treatment
plants design
capacity (MLD)

2020 >>> 1,599
2019 >>> 1,599



Production of water
supplied (MLD)

2020 >>> 1,108
2019 >>> 1,093



Clinical wastes
(metric tonnes)

2020 >>> 3,336.0
2019 >>> 2,360.3



Supply of abstracted raw
water from rivers
(MLD)

2020 >>> 1,297
2019 >>> 1,037



Supply of abstracted raw
water from storage dams
(MLD)

2020 >>> 87
2019 >>> 84



Supply of abstracted raw
water from groundwater
(MLD)

2020 >>> -
2019 >>> -



Flood
incidents

2020 >>> 28
2019 >>> 31



Coastal erosion
(km)

2020 >>> 16.3
2019 >>> 16.3



Road
accidents

2020 >>> 35,234
2019 >>> 47,198



Number of dengue
fever cases

2020 >>> 1,039
2019 >>> 4,107



Fire
incidents

2020 >>> 2,758
2019 >>> 2,860

Notes:

MLD: Million litres per day e: estimate p: preliminary

Source: Environment Statistics, Pulau Pinang, 2021
Department of Statistics Malaysia

RINGKASAN PENEMUAN

SUMMARY OF FINDINGS

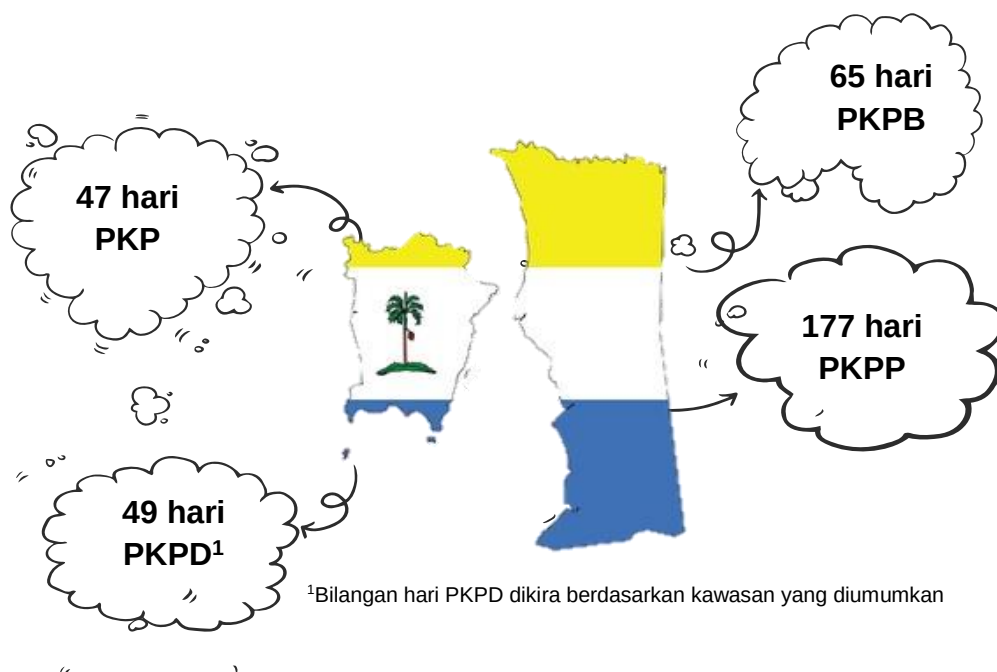


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Pengenalan

Pandemik COVID-19 telah mengubah landskap sosio-ekonomi dunia secara keseluruhan sejak virus ini dikesan pada penghujung 2019. Negeri Pulau Pinang juga tidak terkecuali dari menerima impak pandemik ini. Sehubungan itu, bagi mengawal penularan pandemik ini, Kerajaan mengambil langkah dengan melaksanakan Perintah Kawalan Pergerakan (PKP) pada Mac 2020. Apabila kes jangkitan menunjukkan penurunan, Kerajaan telah melaksanakan Perintah Kawalan Pergerakan Pemulihan (PKPP) dengan membenarkan perjalanan rentas negeri dan daerah sehingga Disember 2020. Namun perjalanan rentas sempadan negeri dan daerah adalah dilarang bagi kawasan yang diisytiharkan Perintah Kawalan Pergerakan Diperketatkan (PKPD) dan Perintah Kawalan Pergerakan Bersyarat (PKPB).



Pelaksanaan PKP ini sedikit sebanyak telah memberi kesan kepada pertumbuhan ekonomi Pulau Pinang di mana pada tahun 2020 Keluaran Dalam Negara Kasar (KDNK) pada harga malar 2015 merekodkan RM92.6 bilion (2019: RM94.7 bilion) menyusut 2.1 peratus. KDNK Pulau Pinang menyumbang 6.9 peratus kepada KDNK Malaysia. Manakala KDNK per kapita adalah RM54,718 berbanding tahun 2019 sebanyak RM55,215. Ini berikutan pelaksanaan sekatan keseluruhan semasa PKP di mana hanya sektor perkhidmatan perlu yang dibenarkan beroperasi selama 47 hari berkuat kuasa 18 Mac 2020 hingga 3 Mei 2020.

Dari perspektif lain, PKP bukan sahaja membantu mengekang penularan COVID-19, tetapi memberi kesan positif kepada alam sekitar. Kesan positif ini boleh dilihat pada Indeks Pencemaran Udara (IPU), kadar kemalangan jalan raya serta kualiti air sungai.



A. Kualiti Alam Sekitar

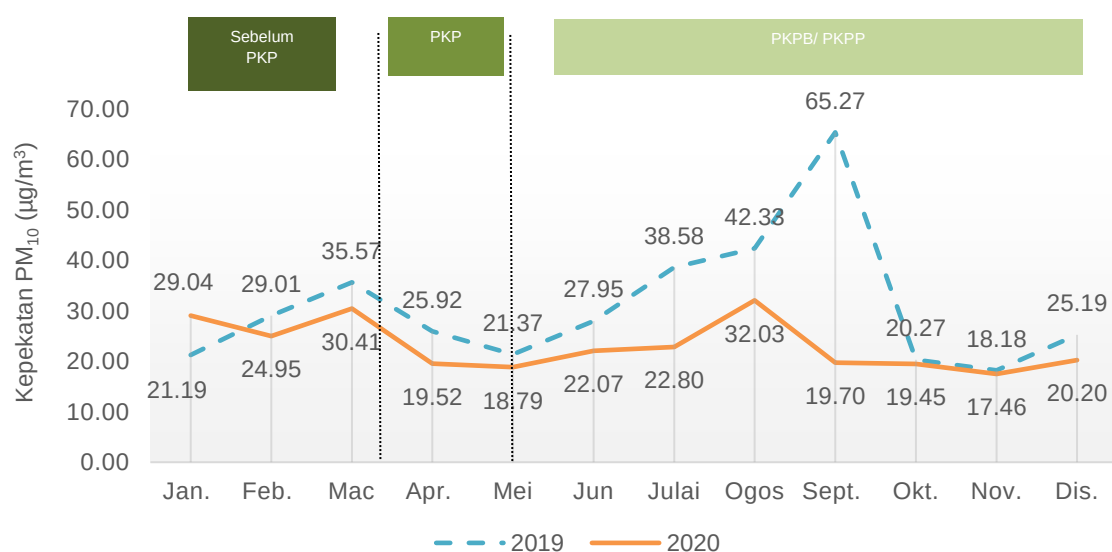
Bahan pencemar udara merupakan bahan kimia di udara yang boleh membahayakan manusia dan alam sekitar. Bahan pencemar boleh berbentuk zarah pepejal, titisan cecair atau gas. Terdapat enam (6) bahan pencemar udara utama iaitu Ozon Permukaan Bumi (O_3), Karbon Monoksida (CO), Sulfur Dioksida (SO_2), Nitrogen Dioksida (NO_2) dan Habuk Halus (PM_{10} & $PM_{2.5}$). Pencemaran udara berlaku apabila bahan pencemar ini hadir di atmosfera. Punca dan kesan bahan pencemar udara ditunjukkan seperti di **Lampiran 3**.

Habuk Halus (PM_{10} & $PM_{2.5}$)

Habuk Halus (PM_{10} & $PM_{2.5}$) adalah istilah yang digunakan bagi zarah terampai berukuran kurang daripada diameter 10 dan 2.5 mikron. Zarah boleh berbentuk pepejal atau cecair dan ia termasuk aerosol, debu, asap dan debunga. Pembebasan PM_{10} dari ekzos kenderaan bermotor, penjanaan kuasa dan haba, proses perindustrian dan aktiviti pembakaran terbuka yang akan membawa kepada pencemaran udara serta mengancam kesihatan manusia dan tumbuhan.

Trend purata bulanan kepekatan PM_{10} dalam udara di Pulau Pinang sepanjang pelaksanaan PKP yang berkuatkuasa 18 Mac 2020 hingga 3 Mei 2020 (47 hari), PKPB (65 hari) dan PKPP (177 hari) menunjukkan paras terendah berbanding 2019 kecuali pada bulan Jun, Ogos dan Oktober 2020 (Perai); Ogos, Oktober dan November 2020 (Seberang Jaya).

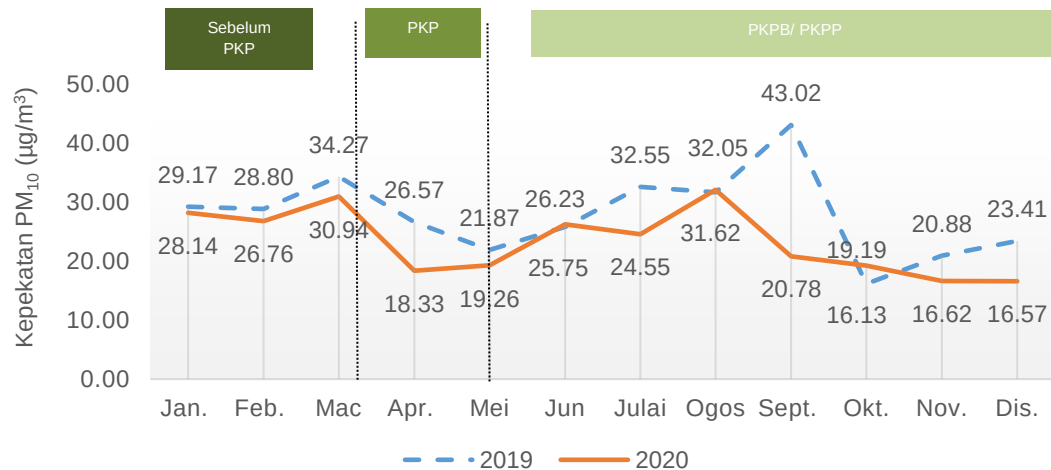
Carta 1.1: Purata bulanan kepekatan PM_{10} di udara, stesen Balik Pulau, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

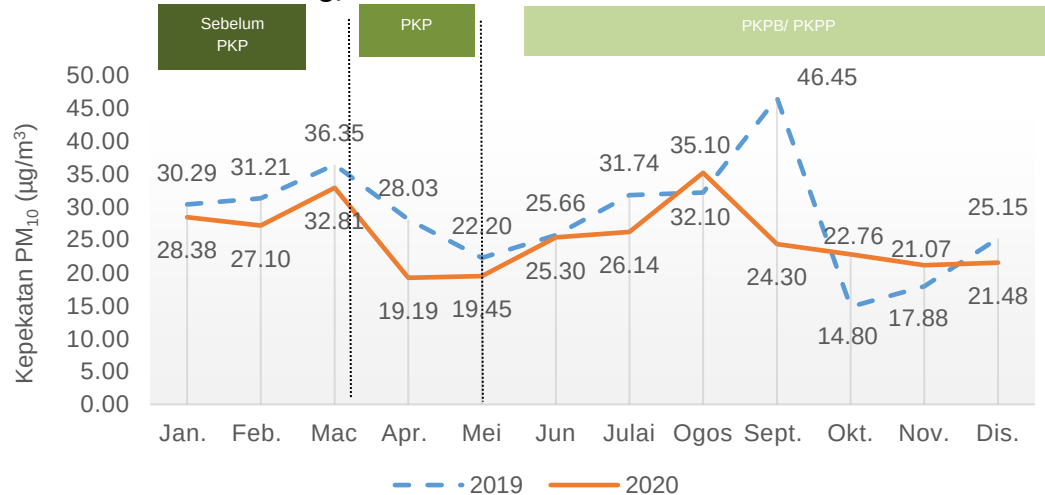


Carta 1.2: Purata bulanan kepekatan PM₁₀ di udara, stesen Perai, Pulau Pinang, 2019 dan 2020



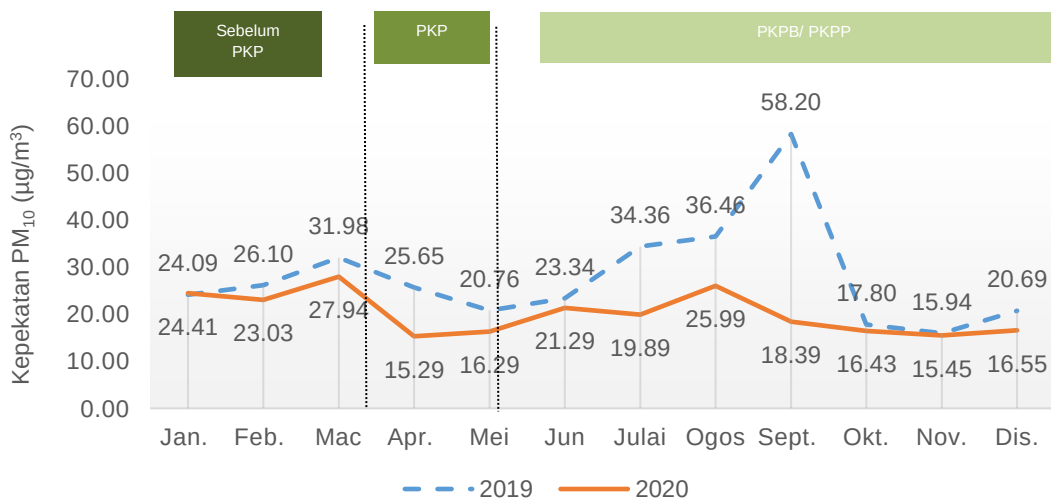
Sumber: Jabatan Alam Sekitar

Carta 1.3: Purata bulanan kepekatan PM₁₀ di udara, stesen Seberang Jaya, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

Carta 1.4: Purata bulanan kepekatan PM₁₀ di udara, stesen USM, Pulau Pinang, 2019 dan 2020

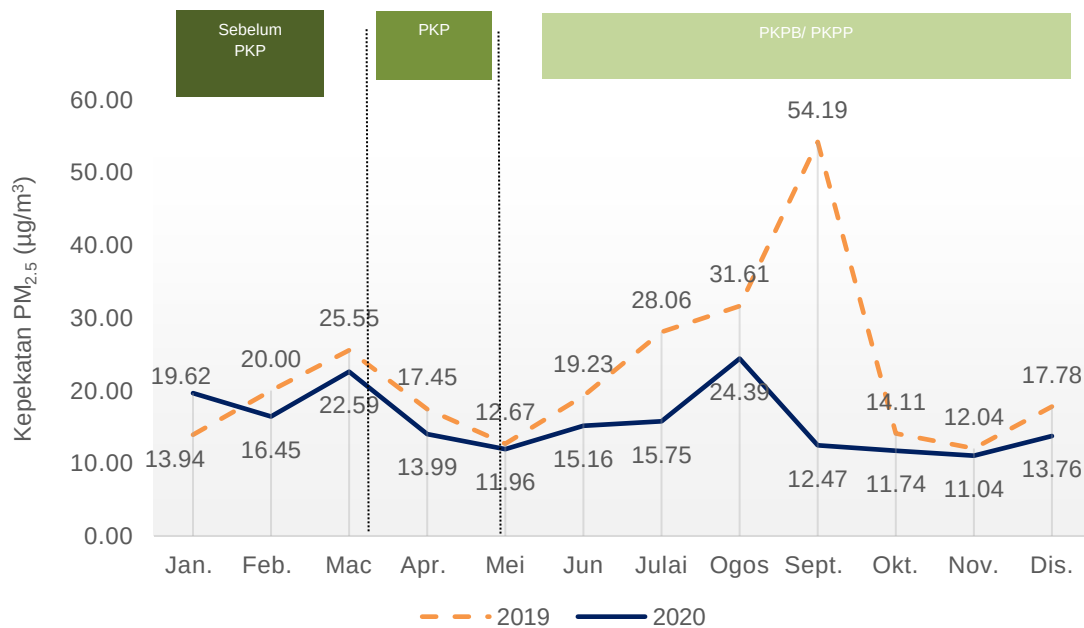


Sumber: Jabatan Alam Sekitar



Pelaksanaan PKP turut memberi kesan yang positif kepada trend purata bulanan kepekatan $PM_{2.5}$ dalam udara di Pulau Pinang pada 2020 di mana $PM_{2.5}$ mencatatkan paras terendah semasa PKP berbanding 2019 kecuali pada bulan Oktober dan November 2020 (Seberang Jaya) dan November 2020 (USM).

Carta 1.5: Purata bulanan kepekatan $PM_{2.5}$ di udara, stesen Balik Pulau, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

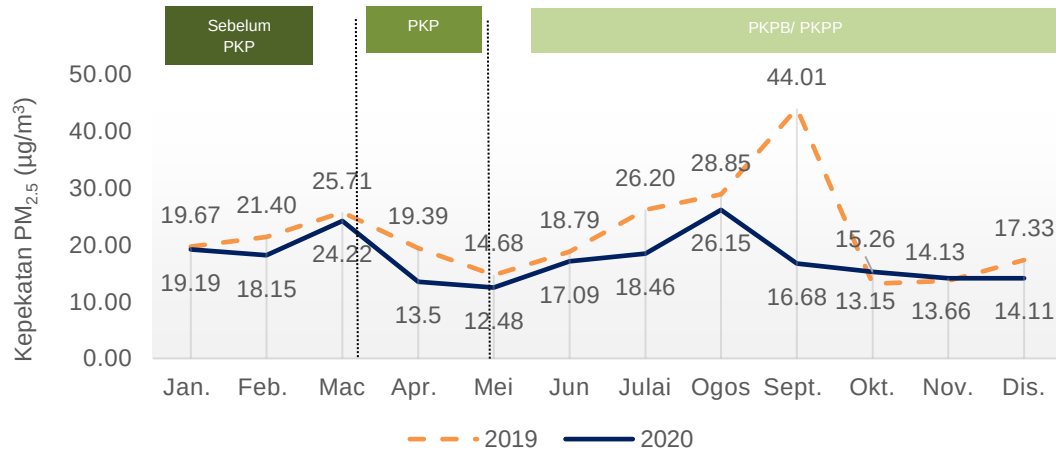
Carta 1.6: Purata bulanan kepekatan $PM_{2.5}$ di udara, stesen Perai, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

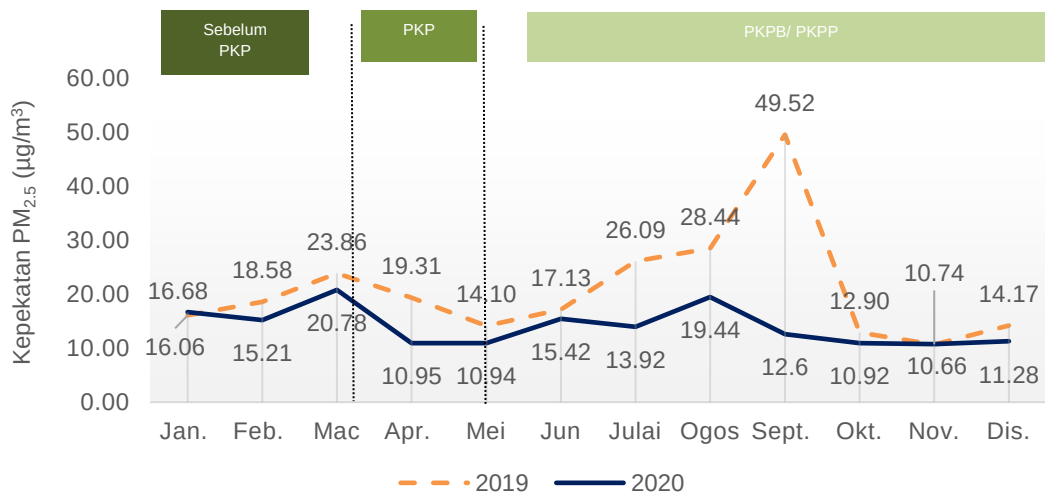


Carta 1.7: Purata bulanan kepekatan PM_{2.5} di udara, stesen Seberang Jaya, Pulau Pinang, 2019 dan 2020



Sumber data: Jabatan Alam Sekitar

Carta 1.8: Purata bulanan kepekatan PM_{2.5} di udara, stesen USM, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

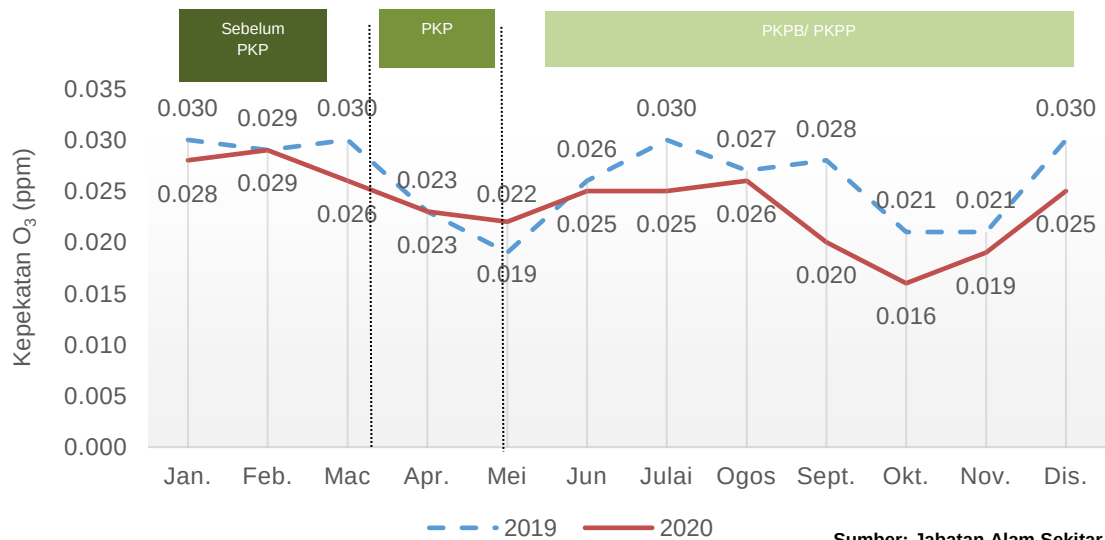
Ozon permukaan bumi (O₃)

O₃ adalah bahan pencemar yang terjadi akibat daripada reaksi kimia dalam udara di antara sebatian organik meruap (VOC) dan nitrogen oksida (NO_x). VOC dan NO_x ini dihasilkan oleh punca kenderaan bermotor dan industri.

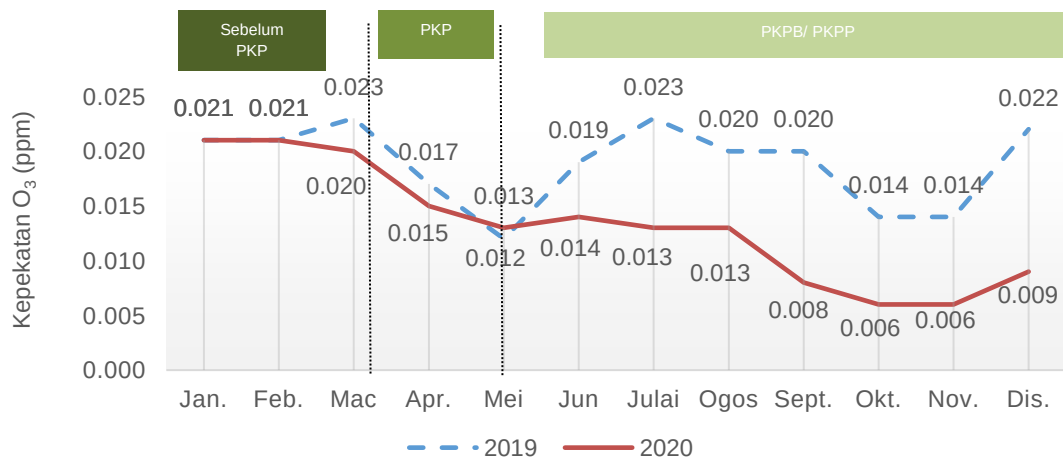
Trend purata bulanan kepekatan O₃ dalam udara menurun sepanjang pelaksanaan PKP. Secara amnya bacaan O₃ pada tahun 2020 adalah lebih rendah berbanding tahun 2019 kecuali pada bulan Mei 2020 (Balik Pulau dan Perai); April hingga Jun 2020 (Seberang Jaya); Mei, Jun dan Ogos (USM). Ini disebabkan pembukaan sektor ekonomi serta kelonggaran pergerakan rentas negeri semasa PKPB/PKPP telah meningkatkan pencemaran O₃.



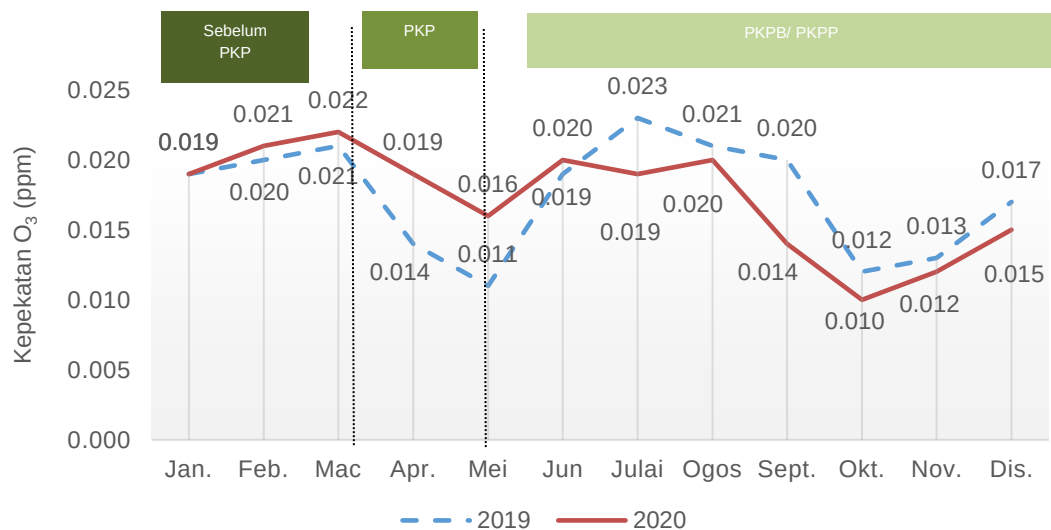
Carta 1.9: Purata bulanan kepekatan O₃ di udara, stesen Balik Pulau, Pulau Pinang, 2019 dan 2020



Carta 1.10: Purata bulanan kepekatan O₃ di udara, stesen Perai, Pulau Pinang, 2019 dan 2020

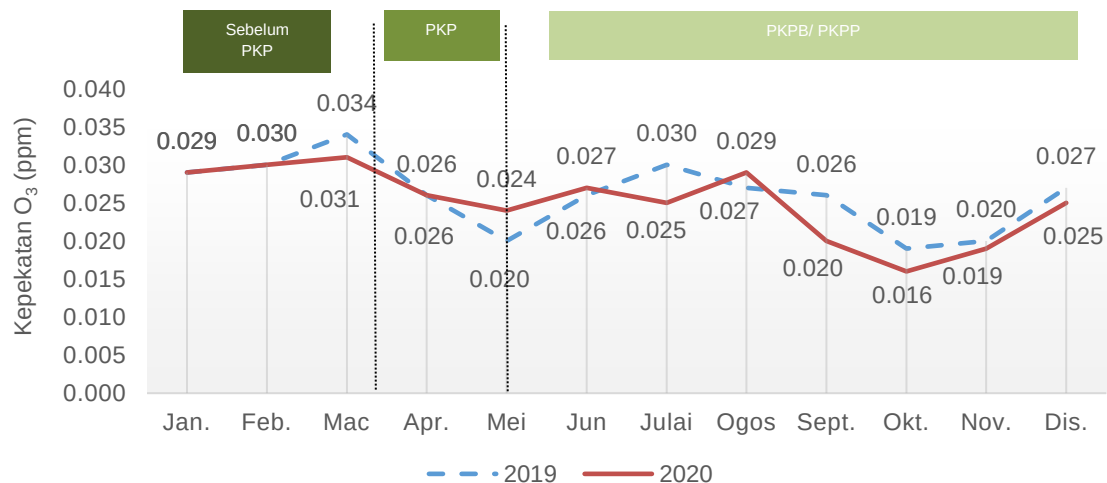


Carta 1.11: Purata bulanan kepekatan O₃ di udara, stesen Seberang Jaya, Pulau Pinang, 2019 dan 2020





Carta 1.12: Purata bulanan kepekatan O₃ di udara, stesen USM, Pulau Pinang, 2019 dan 2020



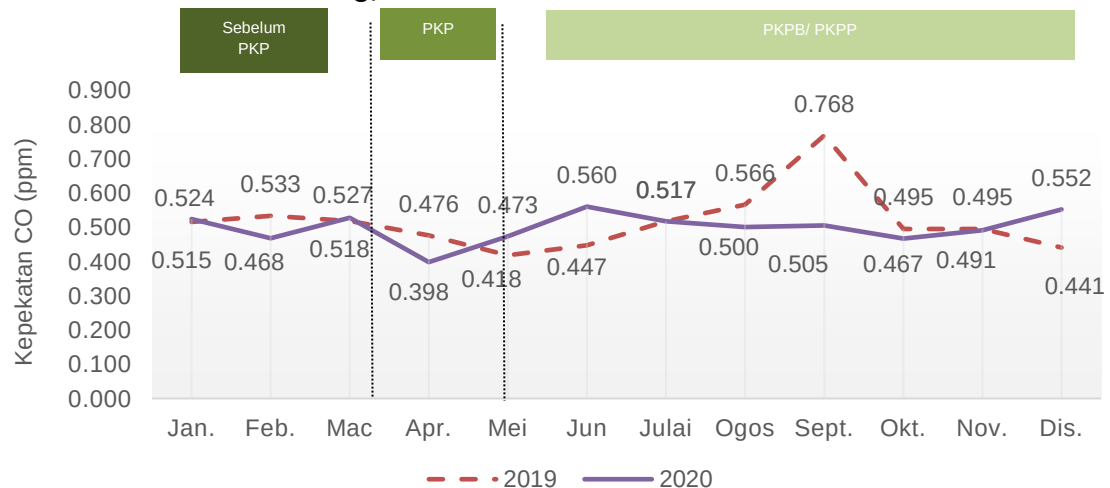
Sumber: Jabatan Alam Sekitar

Karbon Monoksida (CO)

CO merupakan gas yang tidak berwarna, tidak berbau dan beracun yang dihasilkan dari punca pembakaran bahan bakar fosil seperti asap kenderaan, proses perindustrian dan aktiviti pembakaran terbuka.

Trend purata bulanan kepekatan CO dalam udara sepanjang pelaksanaan PKP menunjukkan paras terendah di semua stesen semasa PKP berbanding 2019 disebabkan kawalan pergerakan rentas negeri dan bekerja dari rumah dengan secara tidak langsung mengurangkan penggunaan kenderaan. Namun begitu, pembukaan sektor ekonomi serta kebenaran rentas negeri menyebabkan peningkatan kepekatan CO terutama pada bulan Mei hingga Julai dan Disember 2020 (Balik Pulau); Oktober dan Disember 2020 (Perai); November dan Disember 2020 (USM).

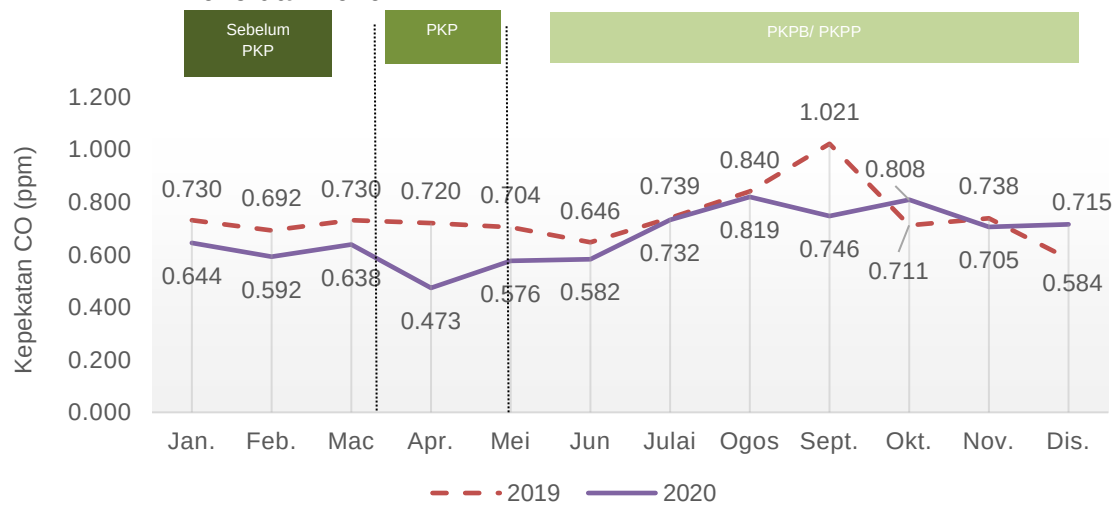
Carta 1.13: Purata bulanan kepekatan CO di udara, stesen Balik Pulau, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

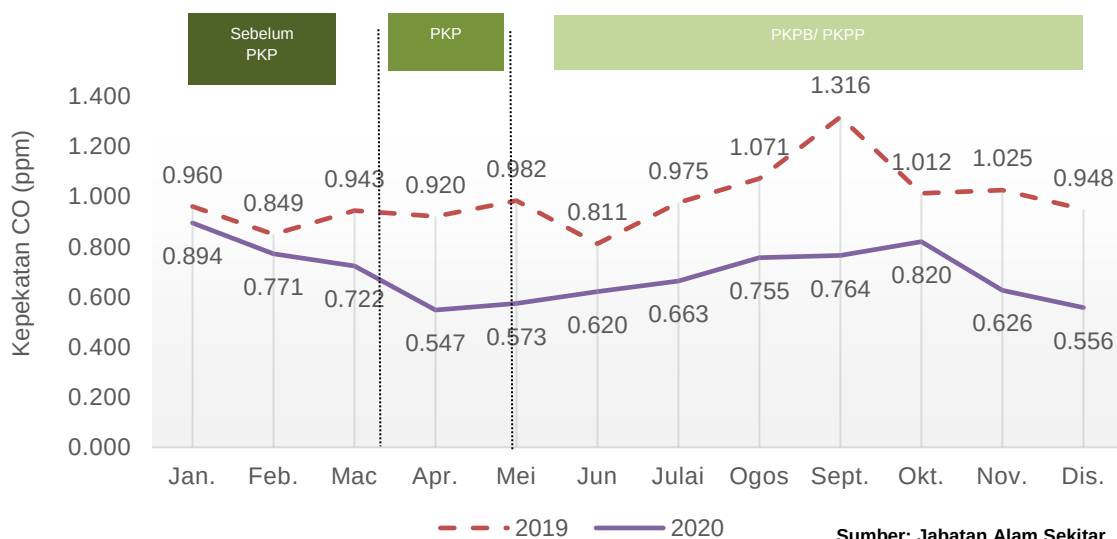


Carta 1.14: Purata bulanan kepekatan CO di udara, stesen Perai, Pulau Pinang, 2019 dan 2020



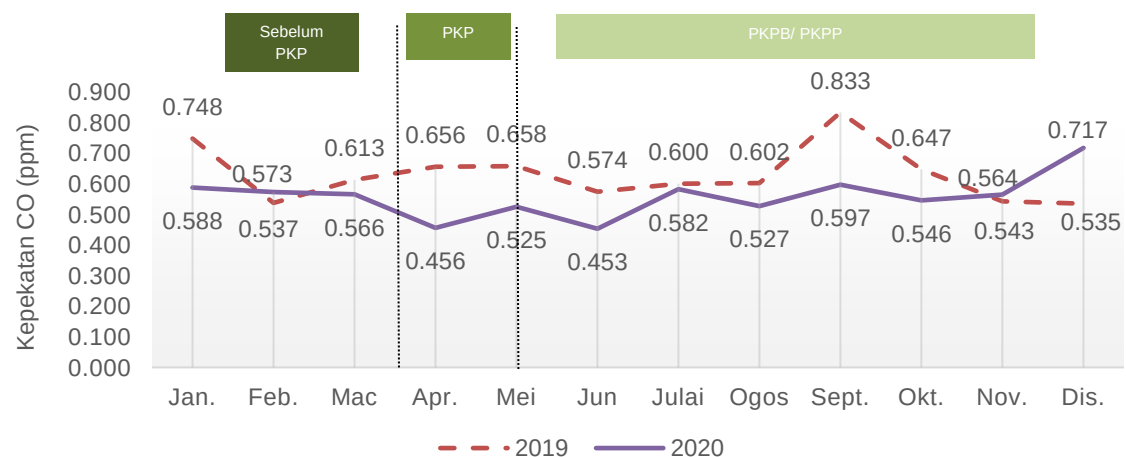
Sumber: Jabatan Alam Sekitar

Carta 1.15: Purata bulanan kepekatan CO di udara, stesen Seberang Jaya, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

Carta 1.16: Purata bulanan kepekatan CO di udara, stesen USM, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

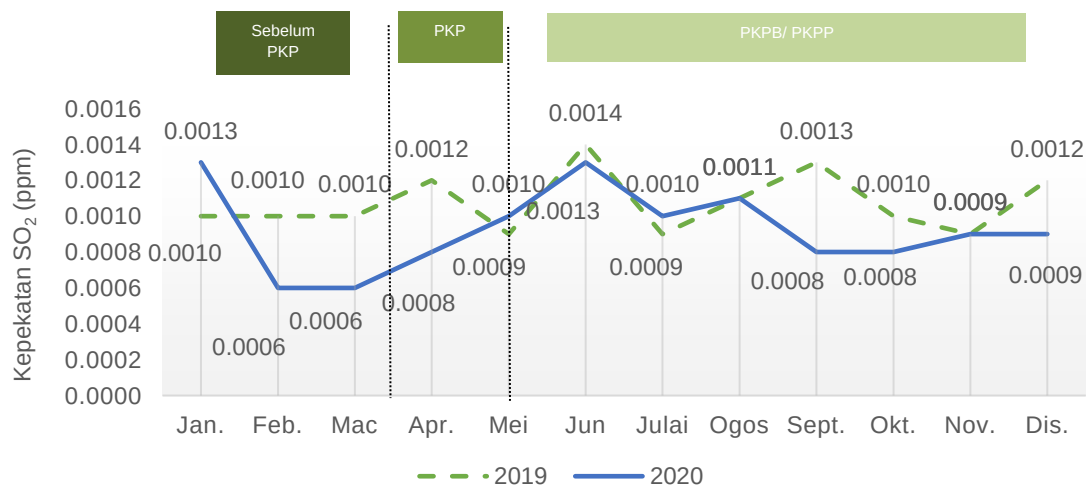


Sulfur Dioksida (SO₂)

SO₂ adalah sejenis gas reaktif yang mudah larut dalam air, tidak berwarna dan mempunyai bau yang tidak menyenangkan. Pendedahan yang berlebihan terhadap kepekatan tinggi SO₂ di udara menyebabkan kerosakan sistem pernafasan dan masalah komplikasi kardiovaskular.

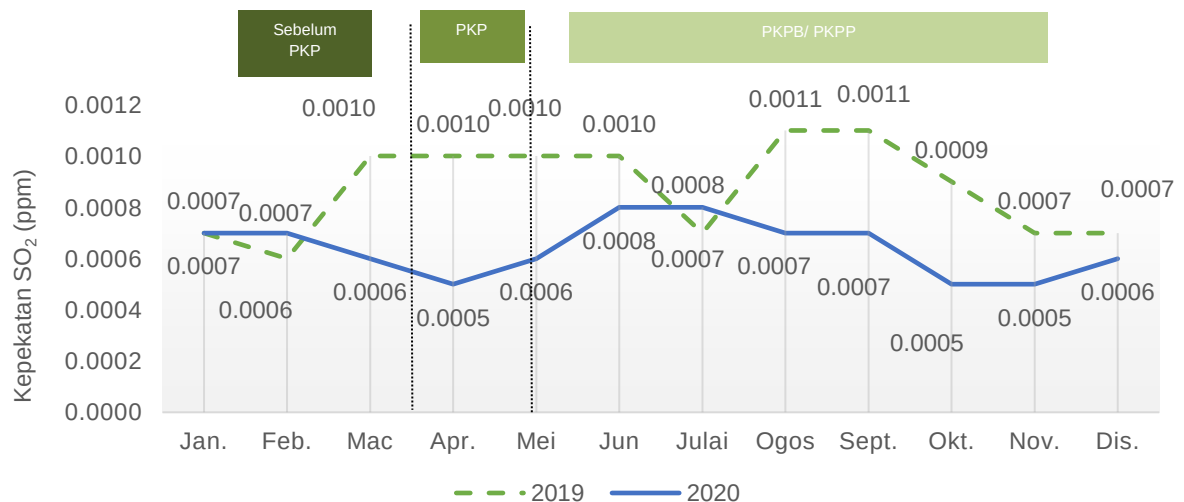
Trend purata bulanan kepekatan SO₂ dalam udara sepanjang pelaksanaan PKP pada 2020 menurun berbanding 2019 kecuali pada bulan Mei, Julai, Ogos dan November 2020 (Balik Pulau); Julai 2020 (Perai); Oktober dan Disember 2020 (Seberang Jaya); Ogos 2020 (USM).

Carta 1.17: Purata bulanan kepekatan SO₂ di udara, stesen Balik Pulau, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

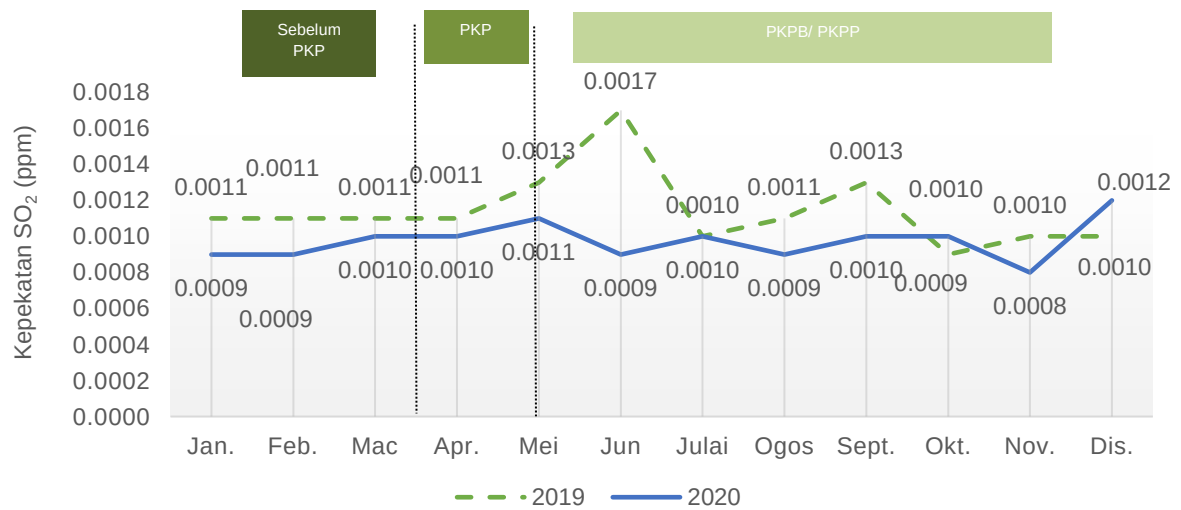
Carta 1.18: Purata bulanan kepekatan SO₂ di udara, stesen Perai, Pulau Pinang, 2019 dan 2020



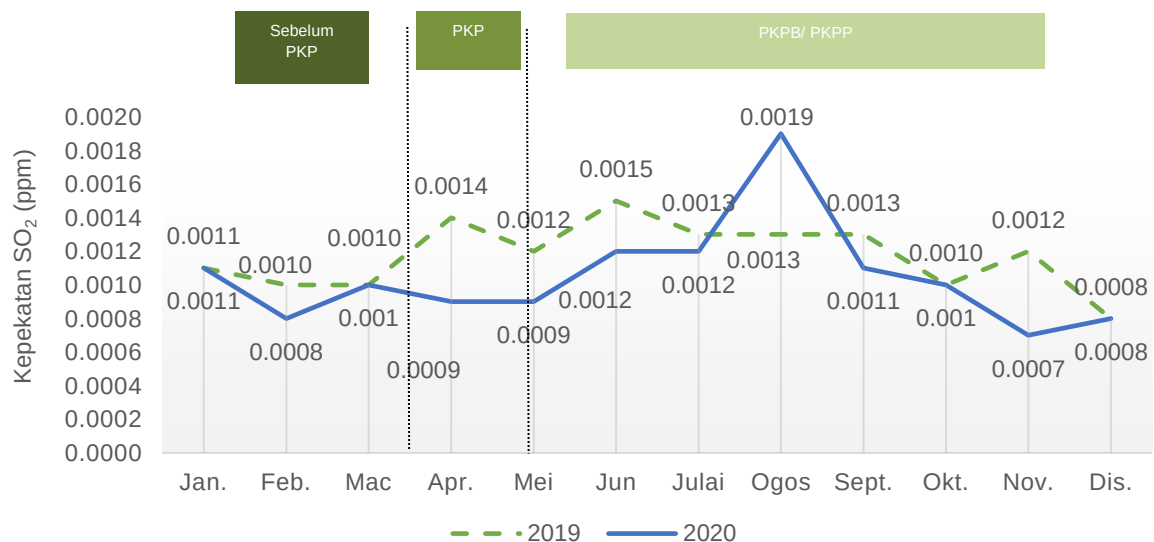
Sumber: Jabatan Alam Sekitar



Carta 1.19: Purata bulanan kepekatan SO₂ di udara, stesen Seberang Jaya, Pulau Pinang, 2019 dan 2020



Carta 1.20: Purata bulanan kepekatan SO₂ di udara, stesen USM, Pulau Pinang, 2019 dan 2020



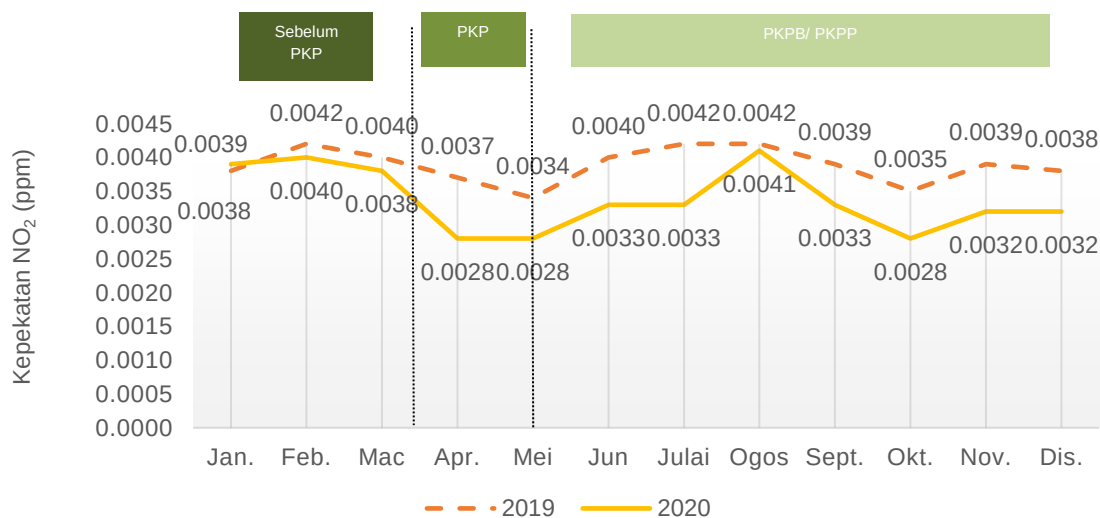
Nitrogen Dioksida (NO₂)

NO₂ terbentuk di persekitaran udara melalui pengoksidaan Nitrogen Monoksida (NO). Gas bertoksik ini berwarna merah keperangan dan mempunyai bau yang kuat dan tajam.

Semua stesen di Pulau Pinang menunjukkan penurunan bagi purata bulanan kepekatan NO₂ dalam udara pada tahun 2020 berbanding 2019.

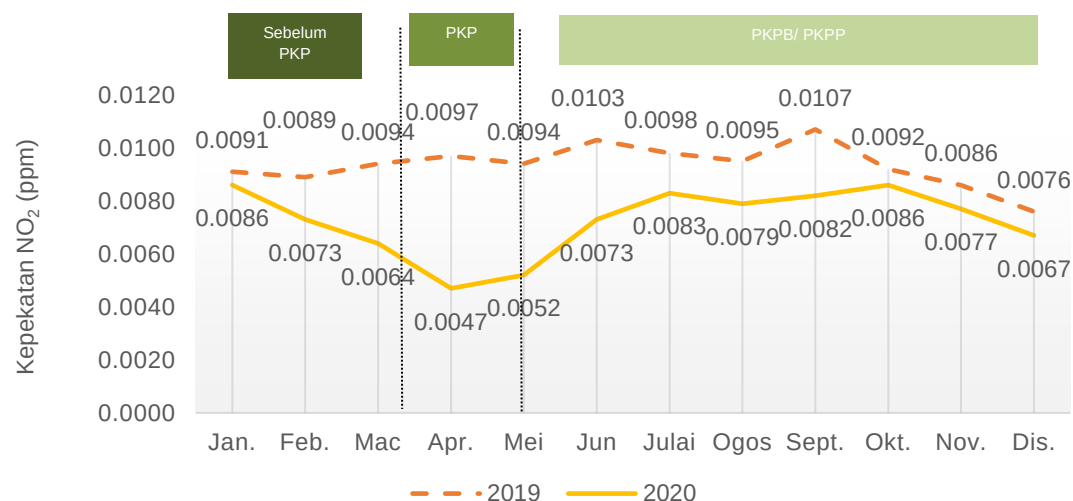


Carta 1.21: Purata bulanan kepekatan NO₂ di udara, stesen Balik Pulau, Pulau Pinang, 2019 dan 2020



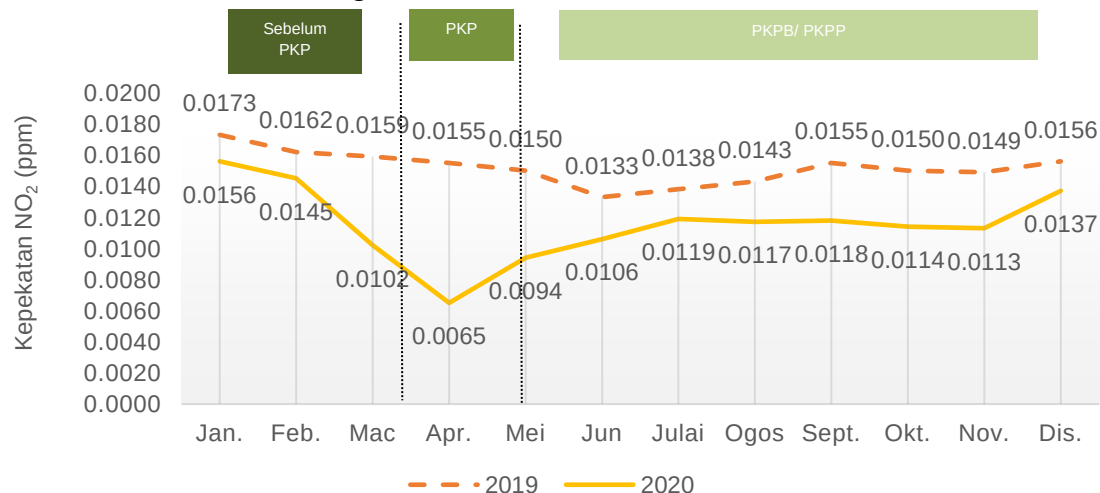
Sumber: Jabatan Alam Sekitar

Carta 1.22: Purata bulanan kepekatan NO₂ di udara, stesen Perai, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

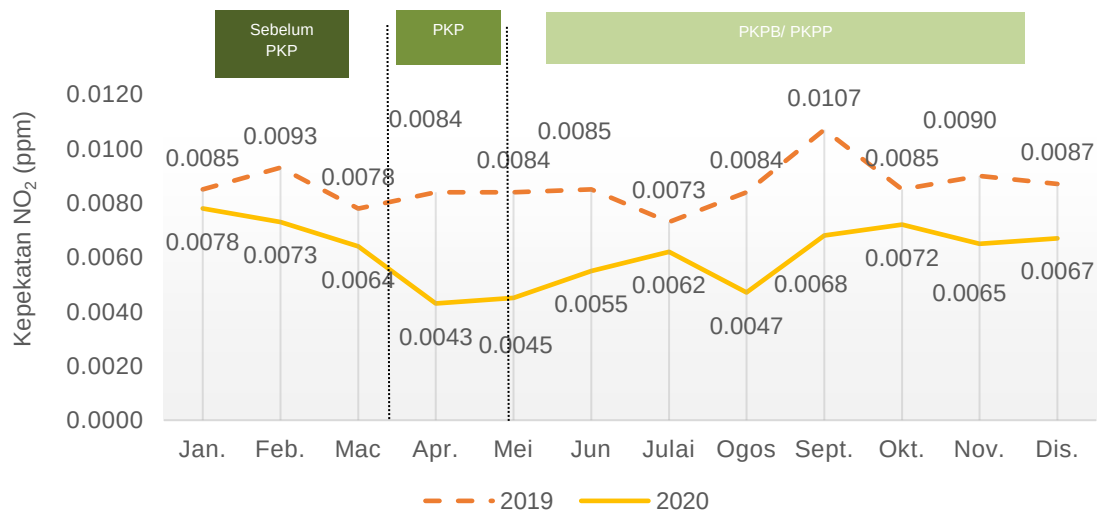
Carta 1.23: Purata bulanan kepekatan NO₂ di udara, stesen Seberang Jaya, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar



Carta 1.24: Purata bulanan kepekatan NO₂ di udara, stesen USM, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Alam Sekitar

B. Purata suhu, hujan dan purata kelembapan relatif

Iklm Malaysia dikategorikan sebagai iklim khatulistiwa yang mempunyai suhu seragam, hujan yang banyak dan lembap sepanjang tahun. Iklim ini dipengaruhi oleh monsun Timur Laut yang bertiup dari bulan November hingga Mac dan monsun Barat Daya dari Mei hingga September. Pantai timur Semenanjung Malaysia dan kawasan pesisiran pantai Sabah dan Sarawak amat dipengaruhi oleh musim monsun Timur Laut. Manakala, pantai barat Semenanjung Malaysia tidak dipengaruhi kerana dilindungi oleh banjaran gunung yang tinggi.

Pulau Pinang mempunyai dua stesen meteorologi untuk memantau keadaan cuaca secara berterusan dan menyediakan data meteorologi untuk kegunaan ramalan cuaca. Stesen-stesen tersebut adalah Bayan Lepas dan Butterworth.

Purata suhu

Stesen Bayan Lepas mencatatkan purata suhu tertinggi iaitu 32.2°C, menurun 0.5°C berbanding 32.7°C pada 2019. Manakala stesen Butterworth merekodkan purata suhu terendah iaitu 24.8°C, berbanding yang direkodkan pada 2019 iaitu 24.7°C. **[Paparan 1.1]**



Paparan 1.1: Purata suhu di stesen meteorologi, Pulau Pinang, 2019 dan 2020

2019		Stesen meteorologi	2020	
Maks.	Min.		Maks.	Min.
32.7 °C	25.5°C	Bayan Lepas	32.2°C	25.4°C
32.4°C	24.7°C	Butterworth	32.1°C	24.8°C

Sumber: Jabatan Meteorologi Malaysia

Taburan hujan

Stesen Butterworth merekodkan hujan tahunan tertinggi pada 2020 iaitu 2,160.8 mm berbanding tahun sebelumnya (2,158.9 mm). Namun begitu, Stesen Bayan Lepas pula mencatatkan hujan tahunan terendah iaitu 1,831.2 mm pada 2020 berbanding tahun sebelumnya (1,740.2 mm). [Paparan 1.2]

Paparan 1.2: Jumlah dan bilangan hari hujan di stesen meteorologi, Pulau Pinang, 2019 dan 2020

2019		Stesen meteorologi	2020	
Jumlah (mm)	Bilangan hari		Jumlah (mm)	Bilangan hari
1,740.2	153	Bayan Lepas	1,831.2	167
2,158.9	158	Butterworth	2,160.8	187

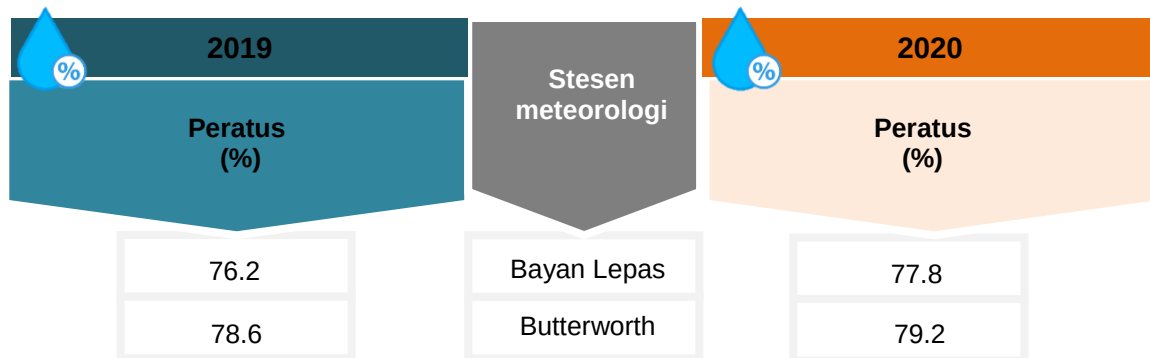
Sumber: Jabatan Meteorologi Malaysia

Purata kelembapan relatif

Purata kelembapan relatif di Pulau Pinang adalah di antara 79.2 peratus (Butterworth) dan 77.8 peratus (Bayan Lepas) pada 2020. Walau bagaimanapun, bacaan ini menurun berbanding 2019 iaitu antara 78.6 peratus (Butterworth) dan 76.2 peratus (Bayan Lepas). [Paparan 1.3]



Paparan 1.3: Purata kelembapan relatif di stesen meteorologi, Pulau Pinang, 2019 dan 2020



Sumber: Jabatan Meteorologi Malaysia

C. Status kualiti udara

Udara merupakan campuran beberapa gas yang membentuk atmosfera bumi. Ia terhasil terutamanya daripada nitrogen (lebih kurang 78.0%), oksigen (lebih kurang 21.0%) dan gas-gas lain (lebih kurang 1.0%). Udara amat penting dalam kehidupan di mana kita menggunakannya untuk pembakaran bahan api bagi tujuan pemanasan, pengangkutan, penjanaan kuasa dan lain-lain.

Indeks Pencemaran Udara

Jabatan Alam Sekitar (JAS) memantau kualiti udara negara melalui 65 stesen pengawasan yang ditempatkan di seluruh negara bagi mengawasi dan mengesan sebarang perubahan kualiti udara yang boleh memberi kesan negatif kepada kesihatan manusia dan alam sekitar.

Status kualiti udara di Malaysia dilaporkan dalam Indeks Pencemaran Udara (IPU). Bahan pencemar udara yang digunakan untuk mengira IPU adalah Ozon (O₃), Karbon Monoksida (CO), Nitrogen Dioksida (NO₂), Sulfur Dioksida (SO₂) dan Habuk Halus bersaiz kurang dari 10 mikron (PM₁₀) dan bersaiz kurang dari 2.5 mikron (PM_{2.5}).

Status Indeks Pencemaran Udara (IPU)

IPU	Status IPU
0-50	Baik
51-100	Sederhana
101-200	Tidak Sihat
201-300	Sangat Tidak Sihat
>300	Berbahaya



Sepanjang pelaksanaan PKP, Pulau Pinang secara keseluruhannya merekodkan kualiti udara berstatus “baik” dan “sederhana” bagi tahun 2020. Stesen USM mencatatkan bilangan hari tertinggi (114 hari) kualiti udara berstatus “baik” pada 2020 berbanding 50 hari tahun sebelumnya. Bacaan IPU menunjukkan penurunan paras pencemar udara, khususnya di bandar-bandar utama di seluruh negeri disebabkan pelepasan bahan pencemar ke udara yang lebih rendah seperti asap kenderaan bermotor, pelepasan asap cerobong industri dan aktiviti pembakaran terbuka. [Paparan 1.4]

Paparan 1.4: Status kualiti udara¹ mengikut stesen, Pulau Pinang, 2019 dan 2020

						Bilangan hari
Stesen	Tahun	Baik (0-50)	Sederhana (51-100)	Tidak Sihat (101-200)	Sangat Tidak Sihat (201-300)	Berbahaya (>300)
Pulau Pinang						
Balik Pulau	2020	83	281	2	-	-
	2019	57	298	8	2	-
Perai	2020	77	289	-	-	-
	2019	44	317	4	-	-
Seberang Jaya	2020	36	330	-	-	-
	2019	30	330	5	-	-
USM	2020	114	252	-	-	-
	2019	50	305	8	2	-

¹Bacaan status kualiti udara berdasarkan bacaan maksimum harian

Sumber: Jabatan Alam Sekitar

D. Sumber air

Air merupakan sumber asas utama yang penting kepada kehidupan manusia, aktiviti sosio-ekonomi seperti aktiviti perindustrian, akuakultur, pengangkutan, pertanian serta penjanaan kuasa. Malaysia memiliki taburan hujan yang banyak serta jaringan sungai yang meluas sebagai sumber air negara. Permintaan terhadap air telah meningkat seiring dengan pertumbuhan penduduk dan peningkatan taraf hidup. Masalah kekurangan air perlu diatasi memandangkan ia boleh menjejaskan aktiviti manusia dan ekonomi. Oleh itu, pengurusan sumber air hendaklah diberi perhatian supaya dapat memenuhi permintaan pengguna yang semakin meningkat.

Sumber air didefinisikan sebagai sumber yang boleh diperolehi untuk kegunaan manusia dan alam sekitar merangkumi sungai, tasik, air bawah tanah, air laut dan sumber air yang lain.



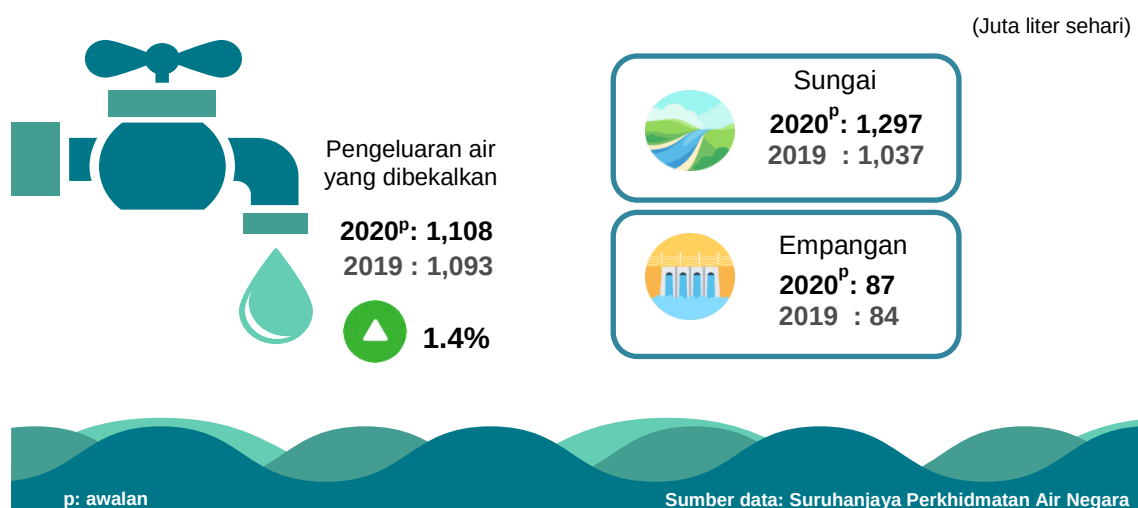
Di Malaysia, 97.0 peratus bekalan air adalah daripada air permukaan manakala selebihnya daripada air bawah tanah. Air bawah tanah berperanan sebagai sumber air alternatif terutama di kawasan tiada bekalan air atau bekalan air tidak mencukupi.

Sumber bekalan air mentah di Pulau Pinang adalah diabstrak dari sungai dan empangan. Pada 2020, jumlah bekalan air mentah yang diabstrak adalah sebanyak 1,384 juta liter sehari (JLH) dimana sungai menyumbang 93.7 peratus manakala selebihnya daripada empangan.

Pengeluaran air yang dibekalkan di Pulau Pinang adalah sebanyak 1,108 JLH pada 2020, meningkat 1.4 peratus berbanding 1,093 JLH yang dicatatkan pada 2019.

[Paparan 1.5]

Paparan 1.5: Pengeluaran air yang dibekalkan dan bekalan air mentah diabstrak mengikut sumber, Pulau Pinang, 2019 dan 2020



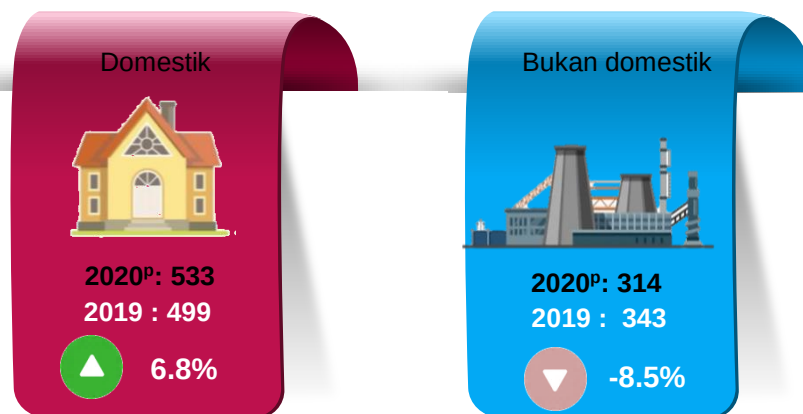
Sektor domestik merujuk kepada air yang digunakan oleh isi rumah untuk menjalankan aktiviti harian seperti membasuh pinggan mangkuk, memasak, mencuci pakaian, mandi, menyiram tanaman dan lain-lain. Manakala, sektor bukan domestik pula merujuk kepada air yang digunakan untuk tujuan komersil, perindustrian, penggunaan awam pertanian dan penternakan.

Penggunaan air bagi sektor domestik di Malaysia meningkat seiring dengan pelaksanaan PKP pada 2020 memandangkan lebih ramai penduduk Malaysia telah bekerja dari rumah. Sementara itu, penggunaan air bermeter bagi sektor domestik negeri Pulau Pinang juga menunjukkan peningkatan sebanyak 6.8 peratus dan sektor bukan domestik menurun sebanyak 8.5 peratus pada 2020 berbanding 2019. [Paparan 1.6]



Paparan 1.6: Penggunaan air bermeter mengikut sektor, Pulau Pinang, 2019 dan 2020

(Juta liter sehari)



Sumber: Suruhanjaya Perkhidmatan Air Negara

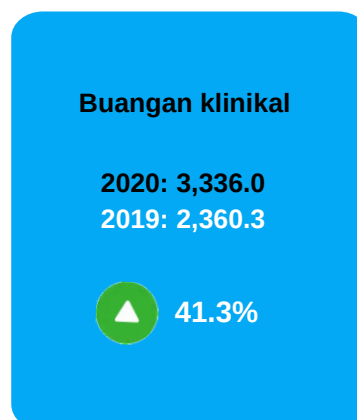
E. Buangan klinikal

Buangan klinikal pula merujuk kepada buangan yang terdiri daripada keseluruhan atau sebahagian tisu manusia, darah atau bendalir badan, bahan kumuh, ubat-ubatan, produk farmaseutikal dan lain-lain. Ia diklasifikasikan sebagai buangan terjadual di bawah Jadual Pertama Peraturan Kualiti Alam Sekeliling (Buangan Terjadual), 2005.

Pandemik COVID-19 memberi kesan secara langsung ke atas buangan klinikal disebabkan penggunaan peralatan perlindungan diri (PPE) dan peralatan ujian COVID-19 dalam pengendalian pesakit COVID-19 di kemudahan kesihatan dan pusat kuarantin. Pulau Pinang juga mencatatkan 3,336.0 tan metrik buangan klinikal pada 2020 berbanding 2,360.3 tan metrik yang direkodkan pada 2019. **[Paparan 1.7]**

Paparan 1.7: Kuantiti buangan klinikal, Pulau Pinang, 2019 dan 2020

(Tan metrik)

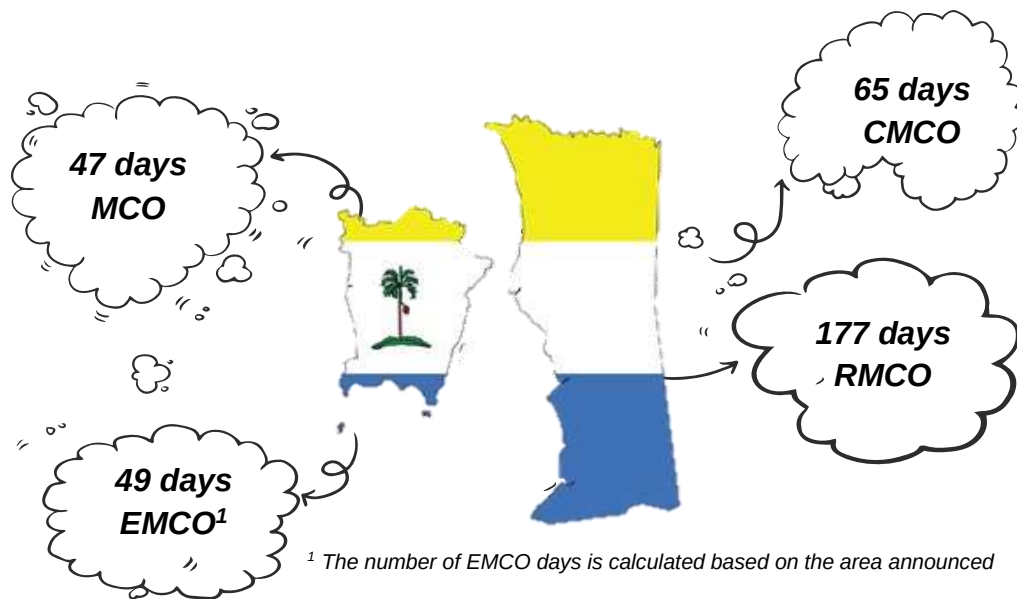


Sumber: Jabatan Alam Sekitar



Introduction

COVID-19 pandemic has changed the world socioeconomic landscape as a whole since the virus was detected in late 2019. Pulau Pinang also experienced the effects of this pandemic. Therefore, to control the spread of the pandemic, the government had taken measures by implementing the Movement Control Order (MCO) in March 2020. When cases of infection showed a decline, the government implemented the Recovery Movement Control Order (RMCO) by allowing cross-country travel and districts until December 2020. However, travel across states and districts for areas under Enhanced Movement Control Order (EMCO) and the Conditional Movement Control Order (CMCO) were prohibited.



The implementation of the MCO has affected Pulau Pinang's economic growth whereby in 2020 Gross Domestic Product (GDP) at a constant 2015 price recorded at RM92.6 billion (2019: RM94.7 billion) declined 2.1 per cent. Pulau Pinang's GDP contributes 6.9 per cent to Malaysia's GDP. Meanwhile, the GDP per capita was RM54,718 compared to 2019 of RM55,215. This was due to the implementation of total lockdown during the MCO whereby only essential sectors were allowed to operate throughout the MCO which applied for 47 days since 18th March 2020 to 3rd May 2020.

From another perspective, MCO had not only curbed the spread of COVID-19, but had a positive impact on the environment. The positive effect can be seen in the Air Pollution Index (API), road accident rate and river water quality.



A. Environmental Quality

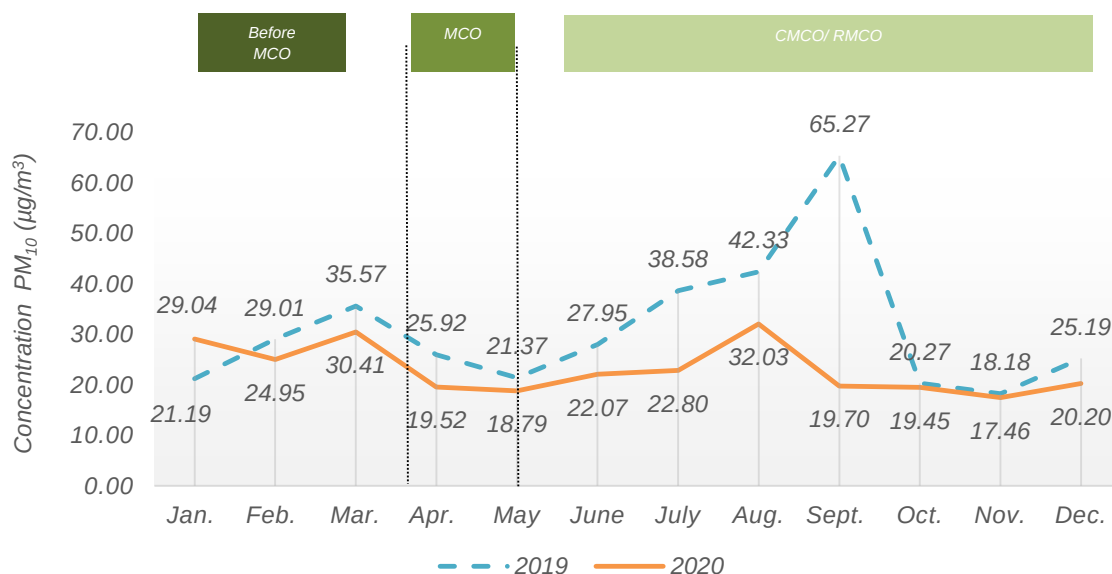
Air pollutants are chemical substances in the air that can be harmful to human beings and the environment. Pollutants can be in the form of solid particles, liquid droplets or gases. There are six (6) primary pollutants namely Ground Level Ozone (O_3), Carbon Monoxide (CO), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10} & $PM_{2.5}$). Air pollution occurs when these pollutants are present in the atmosphere. The sources and effects of air pollutants are shown in **Appendix 3**.

Particulate Matter (PM_{10} & $PM_{2.5}$)

Particulate Matter (PM_{10} & $PM_{2.5}$) is the term used to describe respirable particles of less than 10 and 2.5 micron in diameter. Particles may be solid or liquid and includes aerosol, dust, smoke and pollen. Emission of PM_{10} from motor vehicle exhausts, heat and power generation, industrial processes and open burning activities will lead to air pollution and endangered human health and plants.

The monthly average trend concentration of PM_{10} in the air Pulau Pinang declined during the implementation of MCO effective 18th March 2020 to 3rd May 2020 (47 days), CMCO (65 days) and RMCO (177 days) showed its lowest at all stations as compared to 2019 except in June, August and October 2020 (Perai); August, October and November 2020 (Seberang Jaya).

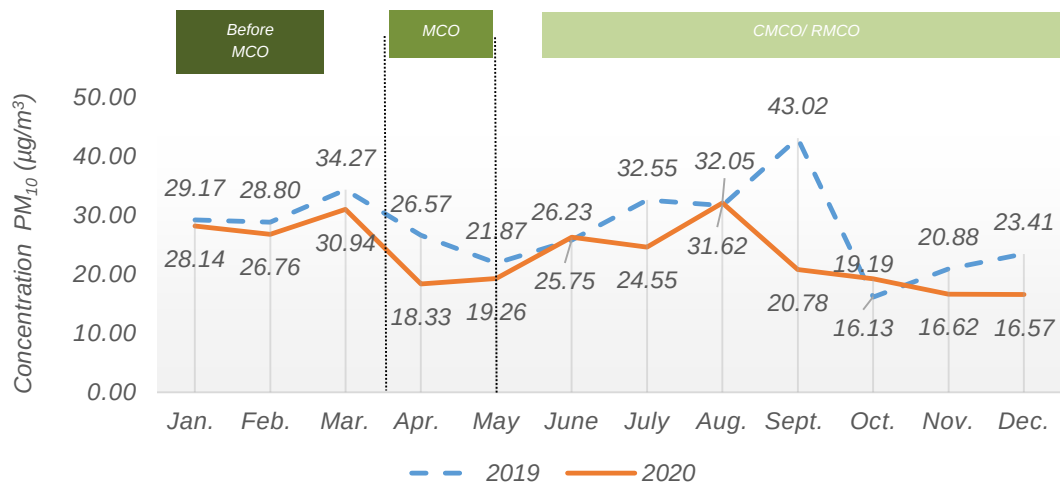
Chart 1.1: Monthly average concentration of PM_{10} in the air, Balik Pulau station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

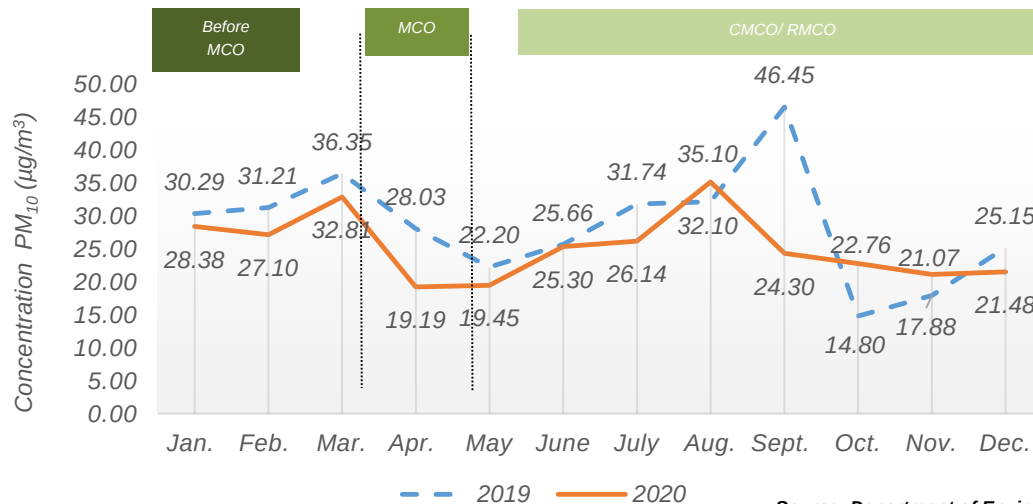


Chart 1.2: Monthly average concentration of PM₁₀ in the air, Perai station, Pulau Pinang, 2019 and 2020



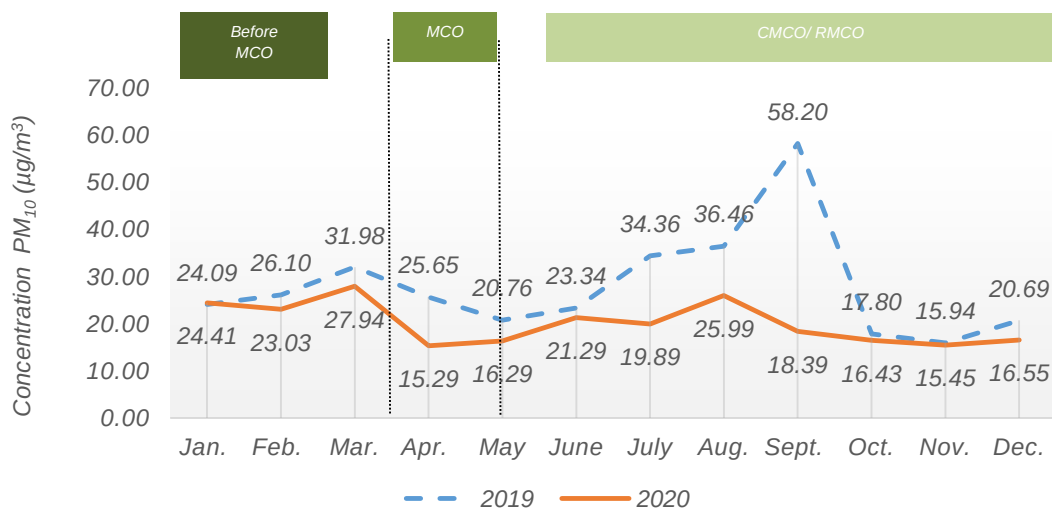
Source: Department of Environment

Chart 1.3: Monthly average concentration of PM₁₀ in the air, Seberang Jaya station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

Chart 1.4: Monthly average concentration of PM₁₀ in the air, USM station, Pulau Pinang, 2019 and 2020

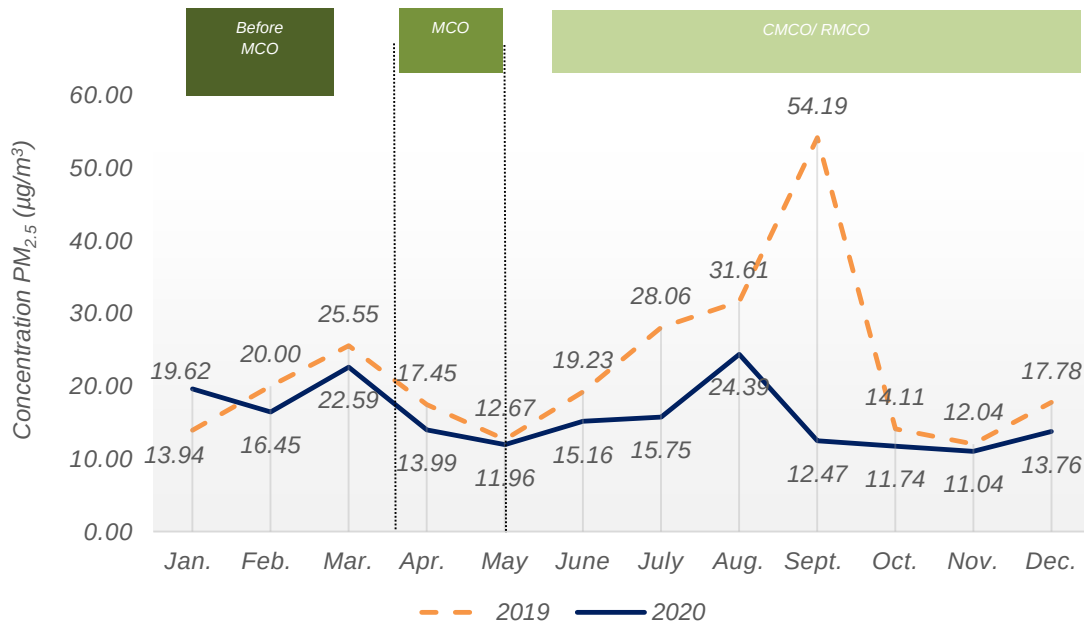


Source: Department of Environment



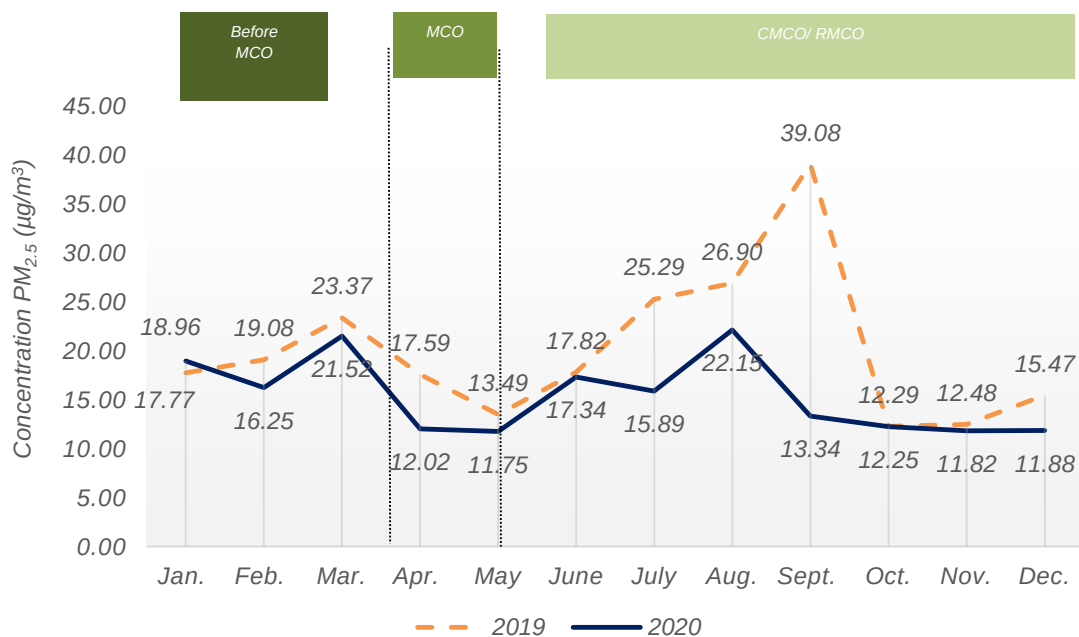
The implementation of MCO also had a positive impact on the monthly average trend of $PM_{2.5}$ concentration in the air in Pulau Pinang in 2020 where $PM_{2.5}$ recorded the lowest level during MCO as compared to 2019 except in October and November 2020 (Seberang Jaya) and November 2020 (USM).

Chart 1.5: Monthly average concentration of $PM_{2.5}$ in the air, Balik Pulau station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

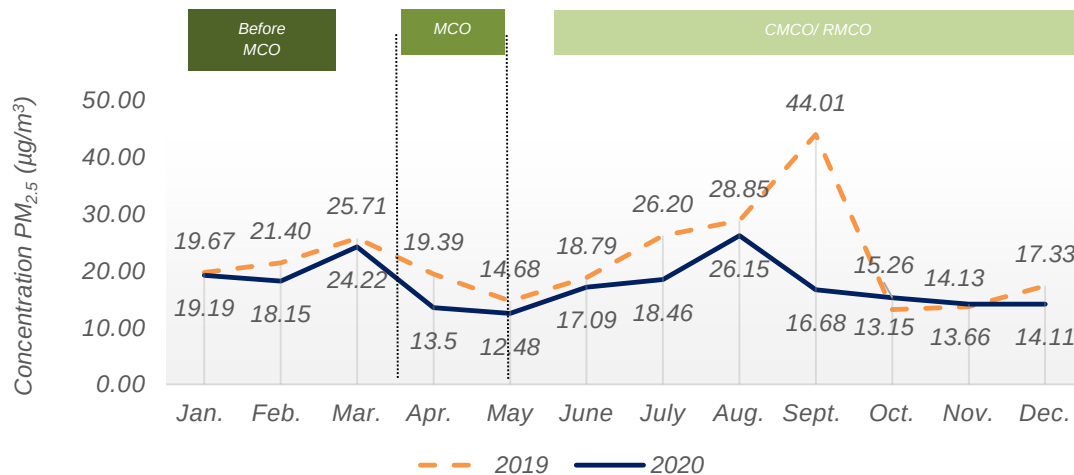
Chart 1.6: Monthly average concentration of $PM_{2.5}$ in the air, Perai station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

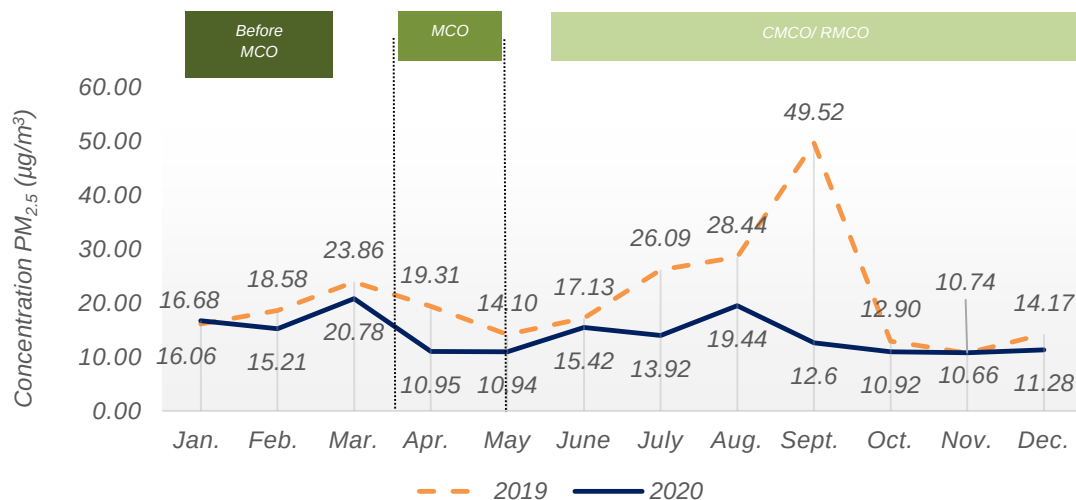


Chart 1.7: Monthly average concentration of PM_{2.5} in the air, Seberang Jaya station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

Chart 1.8: Monthly average concentration of PM_{2.5} in the air, USM station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

Ground level ozone (O₃)

O₃ is a pollutant formed by the chemical reaction in the air between volatile organic compounds (VOCs) and nitrogen oxide (NO_x). These VOCs and NO_x are produced by motor vehicles and industrial sources.

The monthly average trend of O₃ concentration in air declined throughout the implementation of MCO. In general the O₃ reading in 2020 is lower than in 2019 except in May 2020 (Balik Pulau and Perai); April to June 2020 (Seberang Jaya); May, June and August (USM). This is due to the opening of the economic sector as well as the relaxation of cross-state movements during CMCO/RMCO causing an increase pollution O₃.



Chart 1.9: Monthly average concentration of O₃ in the air, Balik Pulau station, Pulau Pinang, 2019 and 2020

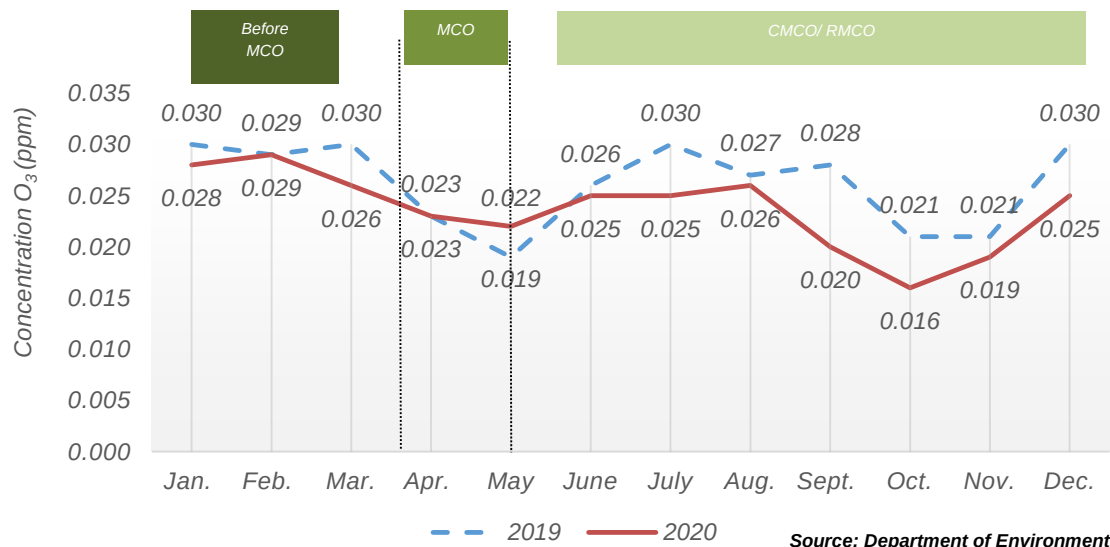


Chart 1.10: Monthly average concentration of O₃ in the air, Perai station, Pulau Pinang, 2019 and 2020

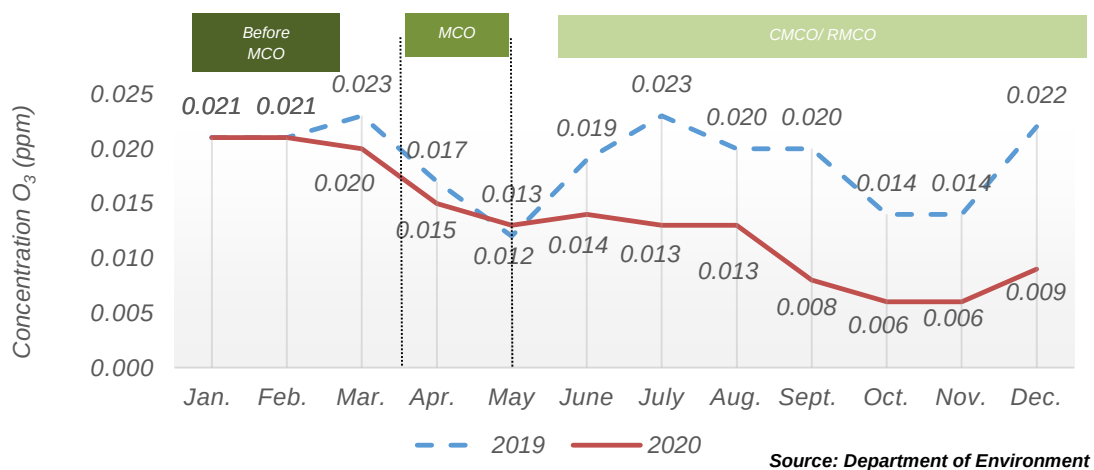


Chart 1.11: Monthly average concentration of O₃ in the air, Seberang Jaya station, Pulau Pinang, 2019 and 2020

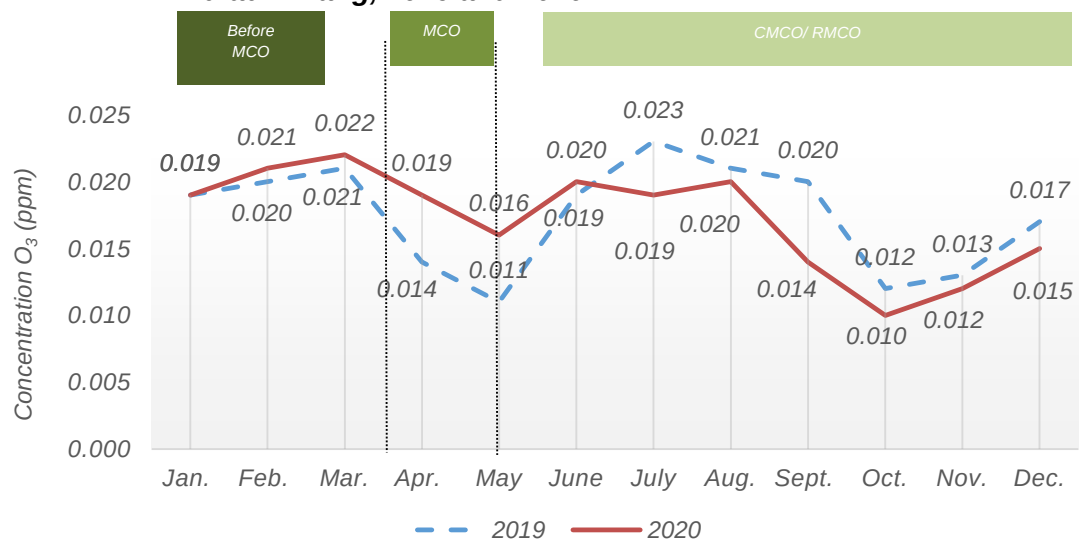
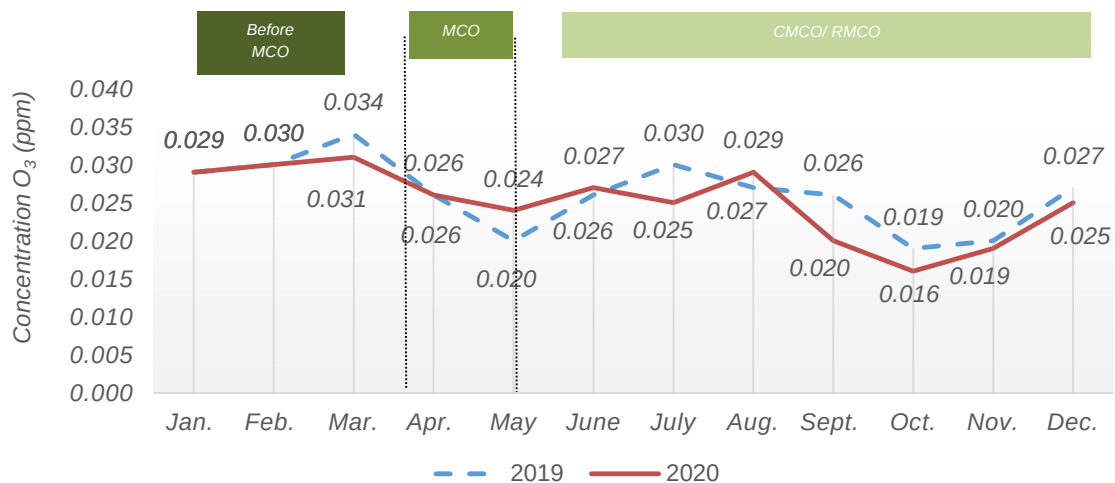




Chart 1.12: Monthly average concentration of O₃ in the air, USM station, Pulau Pinang, 2019 and 2020



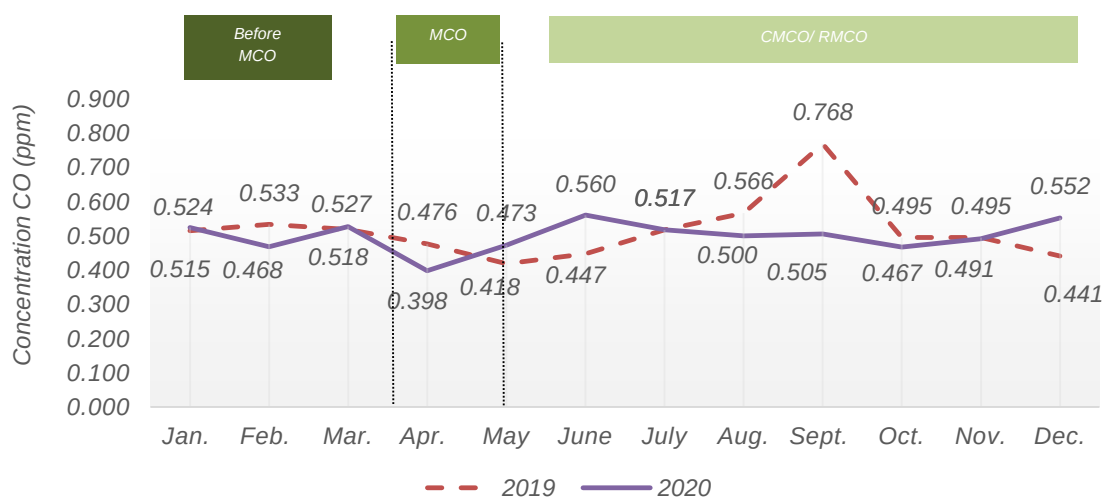
Source: Department of Environment

Carbon Monoxide (CO)

CO is a colourless, odourless and toxic gas produced from fossil fuel combustion sources such as vehicle exhaust, industrial processes and open burning activities.

The monthly average trend of CO concentration in the air throughout MCO implementation showed the lowest level at all stations as compared to 2019 due to cross-state mobility control and working from home by indirectly reducing vehicle usage. However, the opening up of the economic sector as well as cross-state permits led to an increase in CO concentrations especially in May to July and December 2020 (Balik Pulau); October and December 2020 (Perai); November and December 2020 (USM).

Chart 1.13: Monthly average concentration of CO in the air, Balik Pulau station, Pulau Pinang, 2019 and 2020



Source: Department of Environment



Chart 1.14: Monthly average concentration of CO in the air, Perai station, Pulau Pinang, 2019 and 2020



Chart 1.15: Monthly average concentration of CO in the air, Seberang Jaya station, Pulau Pinang, 2019 and 2020

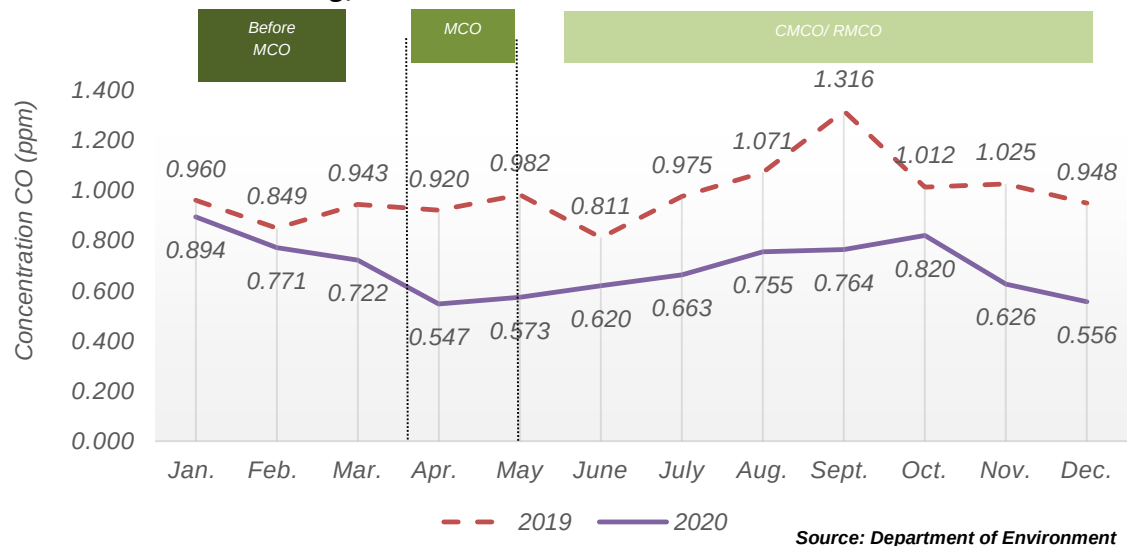
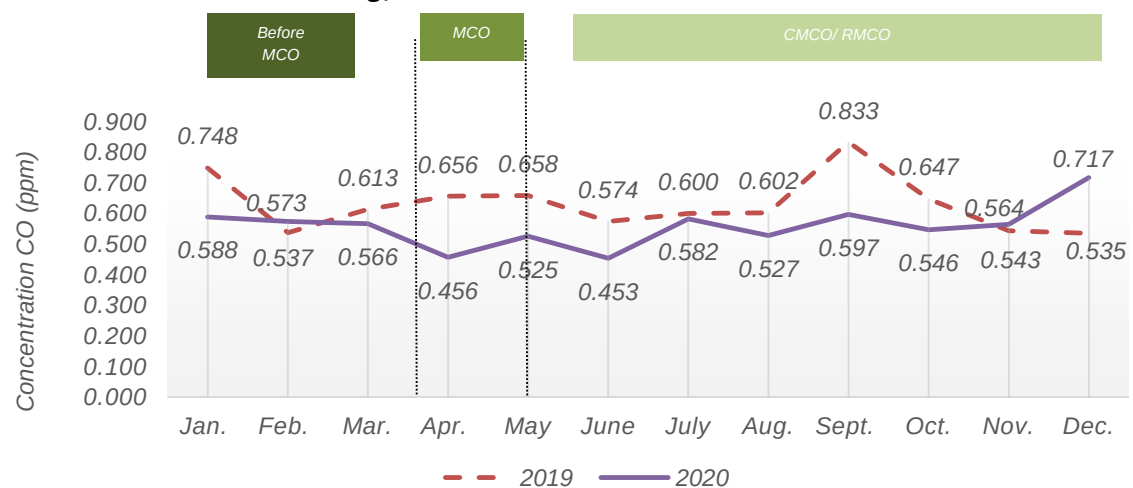


Chart 1.16: Monthly average concentration of CO in the air, USM station, Pulau Pinang, 2019 and 2020





Sulphur Dioxide (SO₂)

SO₂ is colourless, water-soluble reactive gas with an irritating odour. Excessive exposure to high concentration of SO₂ in the atmosphere causes respiratory illnesses and complications of cardiovascular problems.

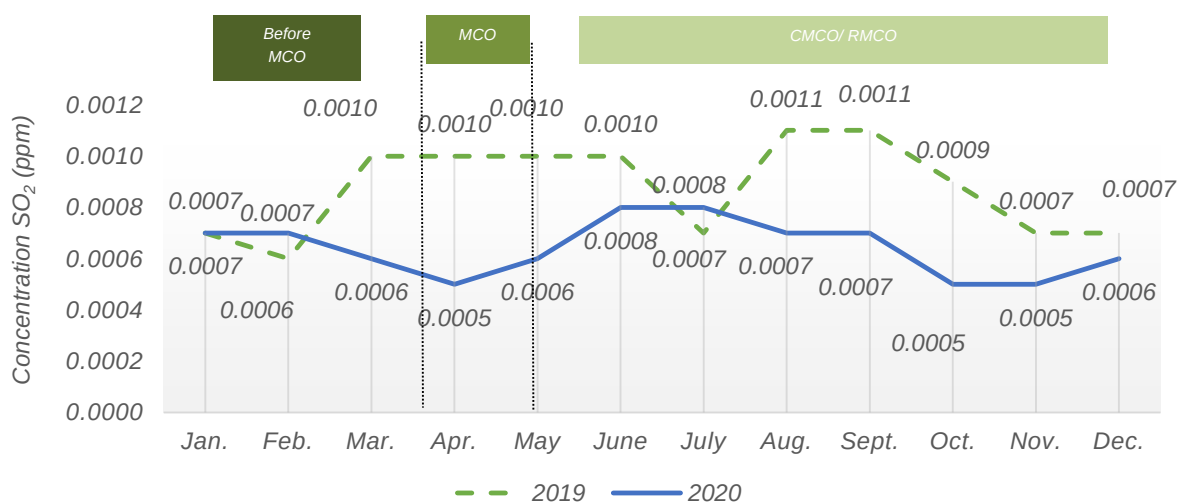
The monthly average trend concentration of SO₂ in the air during the implementation of MCO in 2020 declined as compared to 2019 except in May, July, August and November 2020 (Balik Pulau); July 2020 (Perai); October and December 2020 (Seberang Jaya); August 2020 (USM).

Chart 1.17: Monthly average concentration of SO₂ in the air, Balik Pulau station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

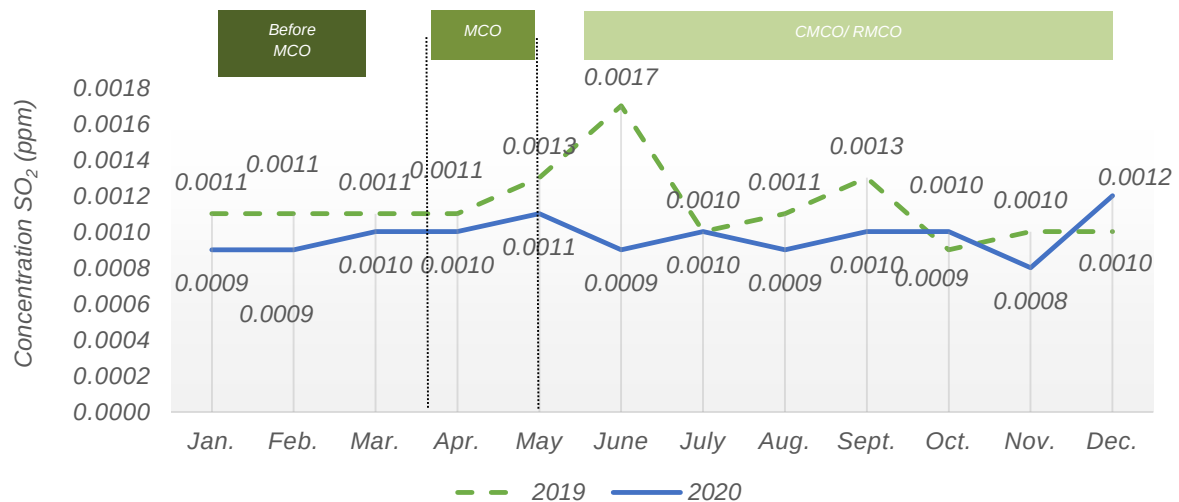
Chart 1.18: Monthly average concentration of SO₂ in the air, Perai station, Pulau Pinang, 2019 and 2020



Source: Department of Environment



Chart 1.19: Monthly average concentration of SO₂ in the air, Seberang Jaya station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

Chart 1.20: Monthly average concentration of SO₂ in the air, USM station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

Nitrogen Dioxide (NO₂)

NO₂ is formed in the ambient air through the oxidation of Nitrogen Monoxide (NO). This reddish brown toxic gas has a sharp and pungent odour.

All stations in Penang showed a decrease in the monthly average concentration of NO₂ in the air in 2020 as compared to 2019.



Chart 1.21: Monthly average concentration of NO₂ in the air, Balik Pulau station, Pulau Pinang, 2019 and 2020

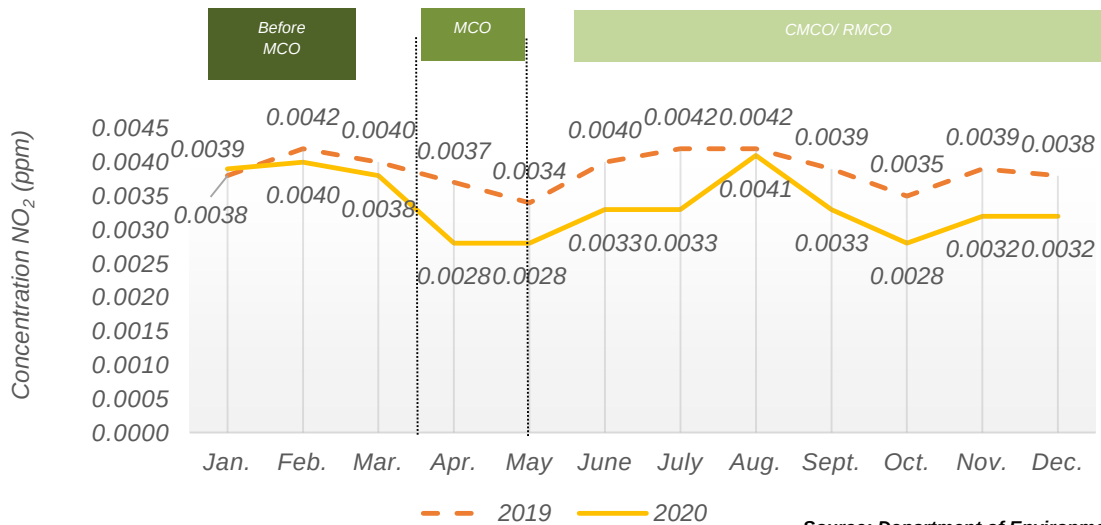


Chart 1.22: Monthly average concentration of NO₂ in the air, Seberang Perai station, Pulau Pinang, 2019 and 2020

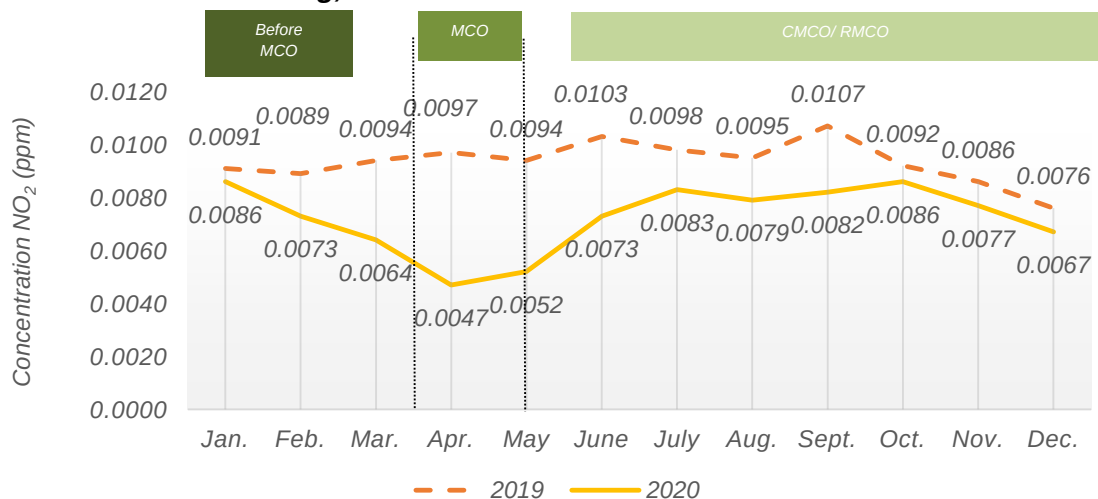


Chart 1.23: Monthly average concentration of NO₂ in the air, Seberang Jaya station, Pulau Pinang, 2019 and 2020

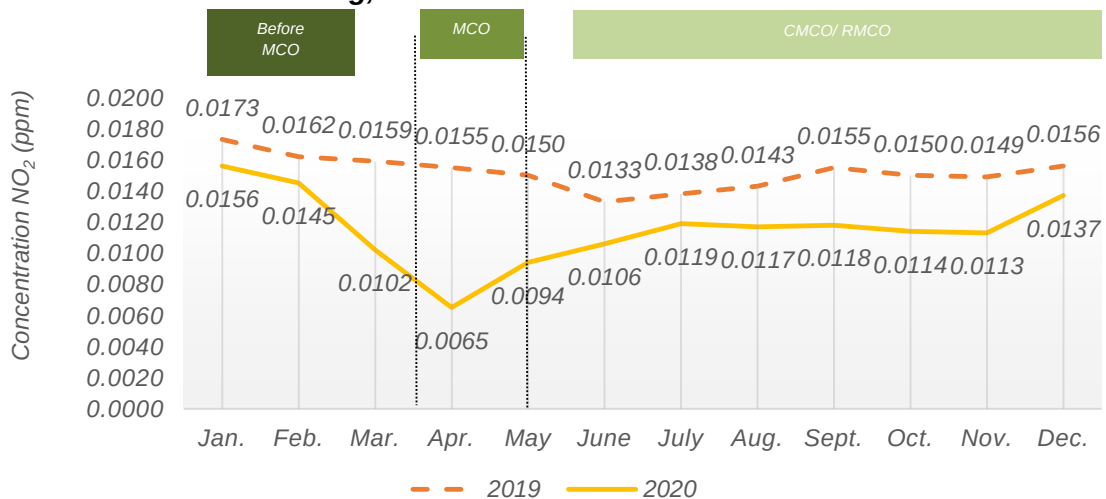
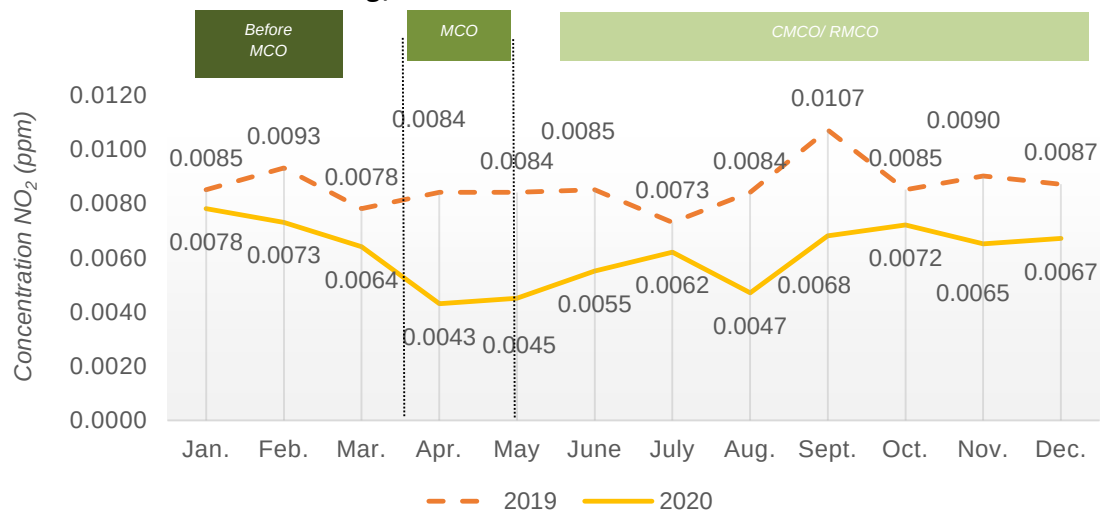




Chart 1.24: Monthly average concentration of NO₂ in the air, USM station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

B. Mean temperature, rainfall and mean relative humidity

Malaysia's climate is categorised as equatorial, has a uniform temperature, copious rainfall and humid throughout the year. This climate is influenced by the Northeast monsoon and Southwest monsoon. Northeast monsoon blows from November to March, while the Southwest monsoon from May to September. The east coast of Peninsular Malaysia and the coastal areas of Sabah and Sarawak are strongly influenced by the Northeast monsoon season. However, the west coast of Peninsular Malaysia is not affected because it is protected by the soaring mountain ranges.

Pulau Pinang has two meteorological stations to monitor the weather conditions continuously and provide meteorological data which are used in weather forecasting. The stations are Bayan Lepas and Butterworth.

Mean temperature

Bayan Lepas station recorded the highest average temperature of 32.2°C, a decrease of 0.5°C compared to 32.7°C in 2019. While Butterworth station recorded the lowest average temperature of 24.8°C, compared to 24.7°C recorded in 2019. **[Exhibit 1.1]**



Exhibit 1.1: Mean temperature at meteorological stations, Pulau Pinang, 2019 and 2020

2019		Meteorological stations	2020	
Max.	Min.		Max.	Min.
32.7°C	25.5°C	Bayan Lepas	32.2°C	24.5°C
32.4°C	24.7°C	Butterworth	32.1°C	24.8°C

Source: Department of Environment

Rainfall distribution

Butterworth station recorded the highest annual rainfall in 2020 at 2,160.8 mm compared to the previous year (2,158.9 mm). However, Bayan Lepas station recorded the lowest annual rainfall of 1,831.2 mm in 2020 compared to the previous year (1,740.2 mm).

[Exhibit 1.2]

Exhibit 1.2: Total and number of rainfall days at meteorological stations, Pulau Pinang, 2019 and 2020

2019		Meteorological stations	2020	
Total (mm)	No. of days		Total (mm)	No. of days
1,740.2	153	Bayan Lepas	1,831.2	167
2,158.9	158	Butterworth	2,160.8	187

Source: Department of Environment

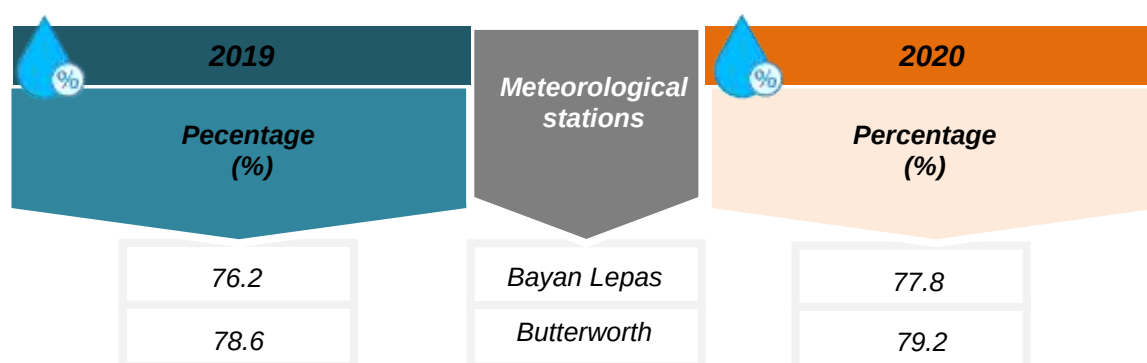
Mean relative humidity

The mean relative humidity in Pulau Pinang was between 79.2 per cent (Butterworth) and 77.8 per cent (Bayan Lepas) in 2020. However, this reading decreased compared to 2019 which is between 78.6 per cent (Butterworth) and 76.2 per cent (Bayan Lepas).

[Exhibit 1.3]



Exhibit 1.3: Mean relative humidity at meteorological stations, Pulau Pinang, 2019 and 2020



Source: Department of Environment

C. Air quality status

Air is the mixture of gases which make up the earth's atmosphere. It is mainly composed of nitrogen (about 78.0%), oxygen (about 21.0%) and other gases (about 1.0%). Air is essential for life as we use it to burn fuels for heating, transportation, power generation and others.

Air Pollution Index

The Department of Environment (DOE) monitors the country's ambient air quality through 65 monitoring stations that are located throughout the country to monitor and to detect any significant change in the air quality that can contribute to the negative impact to human health and the environment.

The status of air quality in Malaysia is reported as the Air Pollutant Index (API). The air pollutants used in computing the API are Ozone (O₃), Carbon Monoxide (CO), Nitrogen Dioxide (NO₂), Sulphur Dioxide (SO₂), Particulate Matter of less than 10 microns in size (PM₁₀) and Particulate Matter of less than 2.5 microns in size (PM_{2.5}).

**Status of
Air Pollution
Index (API)**

API	API Status
0-50	Good
51-100	Moderate
101-200	Unhealthy
201-300	Very Unhealthy
>300	Hazardous



During the implementation of the MCO, Pulau Pinang in overall recorded a “good” and “moderate” air quality status for 2020. USM station recorded the highest number of days (114 days) with “good” air quality in 2020 as compared to 50 days in the previous year. API reading showed a decrease in the air pollutants levels, especially in major cities across the state due to lower air pollutant emissions such as motor vehicles smoke, industrial chimney emissions and open burning activities. **[Exhibit 1.4]**

Exhibit 1.4: Status of air quality¹ by station, Pulau Pinang, 2019 and 2020

Exhibit 1.4. Status of air quality by station, Pulau Pinang, 2019 and 2020

Station	Year	Number of days				
		Good (0-50)	Moderate (51-100)	Unhealthy (101-200)	Very Unhealthy (201-300)	Hazardous (>300)
Pulau Pinang						
Balik Pulau	2020	83	281	2	-	-
	2019	57	298	8	2	-
Perai	2020	77	289	-	-	-
	2019	44	317	4	-	-
Seberang Jaya	2020	36	330	-	-	-
	2019	30	330	5	-	-
USM	2020	114	252	-	-	-
	2019	50	305	8	2	-

¹Air quality status readings are based on daily maximum readings

Source: Department of Environment

D. Water resources

Water is very essential to human beings, socioeconomic activities such as industrial activities, aquaculture, transportation, agriculture and generation of energy. Malaysia has an abundant rainfall and an extensive river system as national water resources. The water demand has increased as the population grows and improvements in the standard of living. Water shortage should be overcome since it would affect human and economic activities. As such, the management of water resources should be addressed in order to meet the increasing demand.

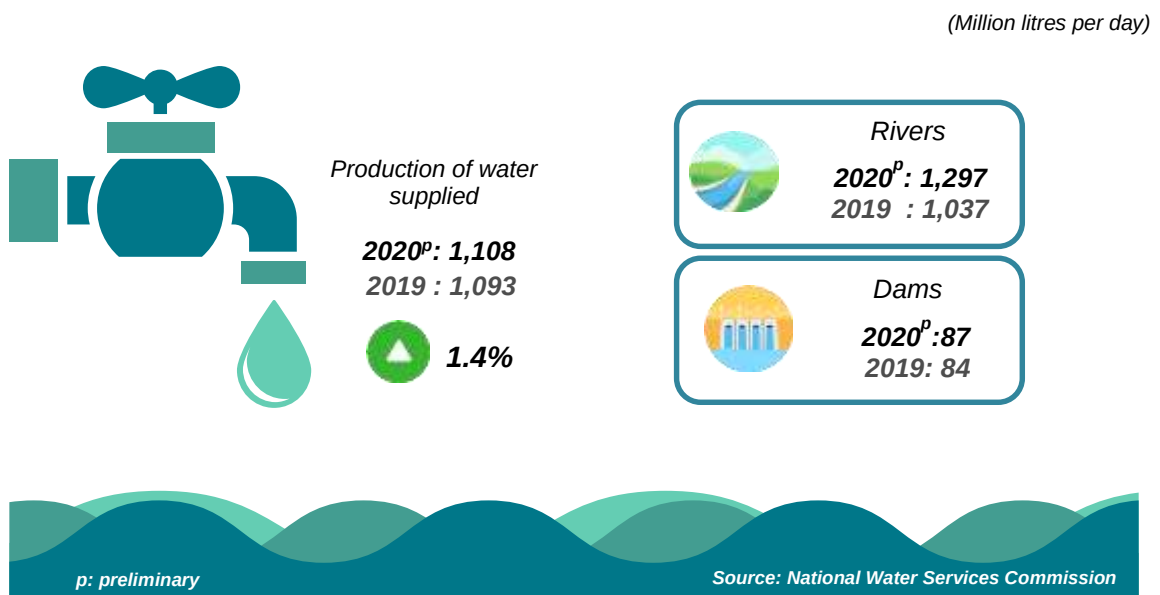
Water resources are resources acquired for human consumption and the environment comprising rivers, lakes, groundwater, seawater and other sources.

In Malaysia, 97.0 per cent of water supply is from surface water while the remaining is from groundwater. Groundwater is an alternative source of water, especially in areas where surface water supply is inadequate or unavailable.



The source of abstracted raw water supply in Pulau Pinang are from rivers and dams. In 2020, the total of abstracted raw water supply is 1,384 million litres per day (MLD) where rivers account for 93.7 per cent while the rest is from dams. Volume production of water supplied in Pulau Pinang was 1,108 MLD in 2020, an increase of 1.4 per cent as compared to 1,093 MLD recorded in 2019. **[Exhibit 1.5]**

Exhibit 1.5: Production of water supplied and supply of abstracted raw water by source, Pulau Pinang, 2019 and 2020



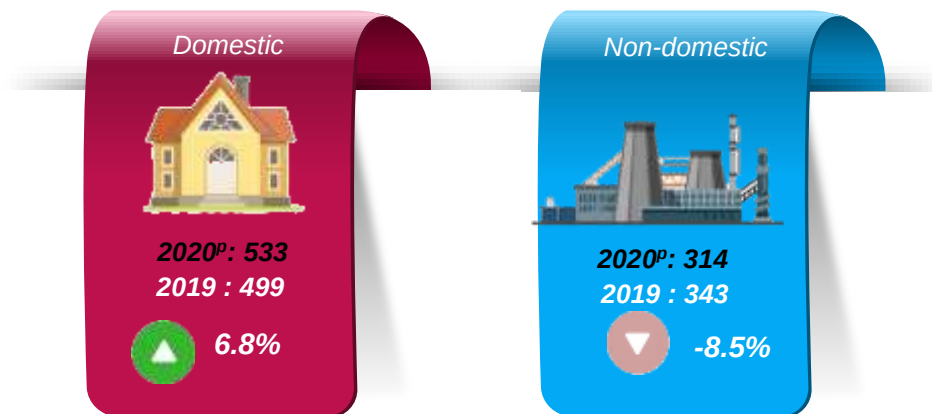
The domestic sector refers to water used by households to carry out daily activities such as washing dishes, cooking, washing clothes, bathing, watering plants and others. Meanwhile, the non-domestic sector refers to water used for commercial, industrial and general use in agriculture and livestock.

The increase in water consumption for the domestic sector in Malaysia is in line with the implementation of the MCO in 2020 as more Malaysians worked from home. Meantime, metered water consumption for the domestic category Pulau Pinang also showed an increase of 6.8 per cent and non-domestic decreased by 8.5 per cent in 2020 as compared to 2019. **[Exhibit 1.6]**



Exhibit 1.6: Metered water consumption by sector, Pulau Pinang, 2019 and 2020

(Million litres per day)



Source: National Water Services Commission

E. Clinical waste

Clinical waste refers to any waste which consists wholly or partly of human tissues, blood or body fluids, excretions, drugs or pharmaceutical products and others. It is classified as scheduled waste under the First Schedule Environmental Quality (Scheduled Wastes) Regulations, 2005.

The COVID-19 pandemic had a direct impact on clinical waste due to the use of personal protective equipment (PPE) and COVID-19 test equipment in the handling of COVID-19 patients in health facilities and quarantine centers. Pulau Pinang also recorded 3,336.0 metric tonnes of clinical waste in 2020 as compared to 2,360.3 metric tonnes recorded in 2019. [Exhibit 1.7]

Exhibit 1.7: Quantity of clinical waste, Pulau Pinang, 2019 and 2020

(Metric tonnes)



Source: Department of Environment



Chart 1.14: Monthly average concentration of CO in the air, Perai station, Pulau Pinang, 2019 and 2020



Chart 1.15: Monthly average concentration of CO in the air, Seberang Jaya station, Pulau Pinang, 2019 and 2020

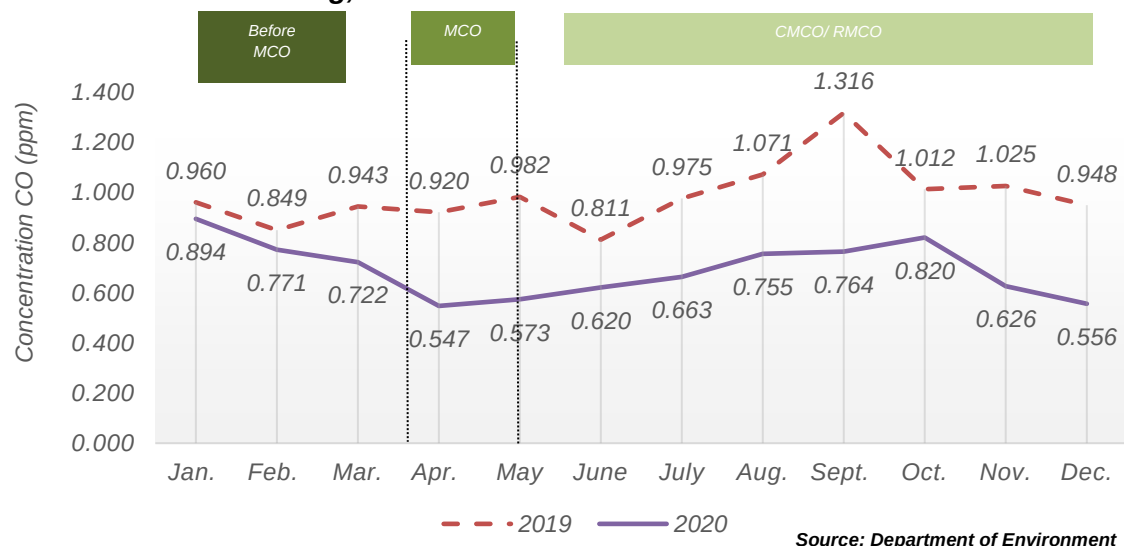
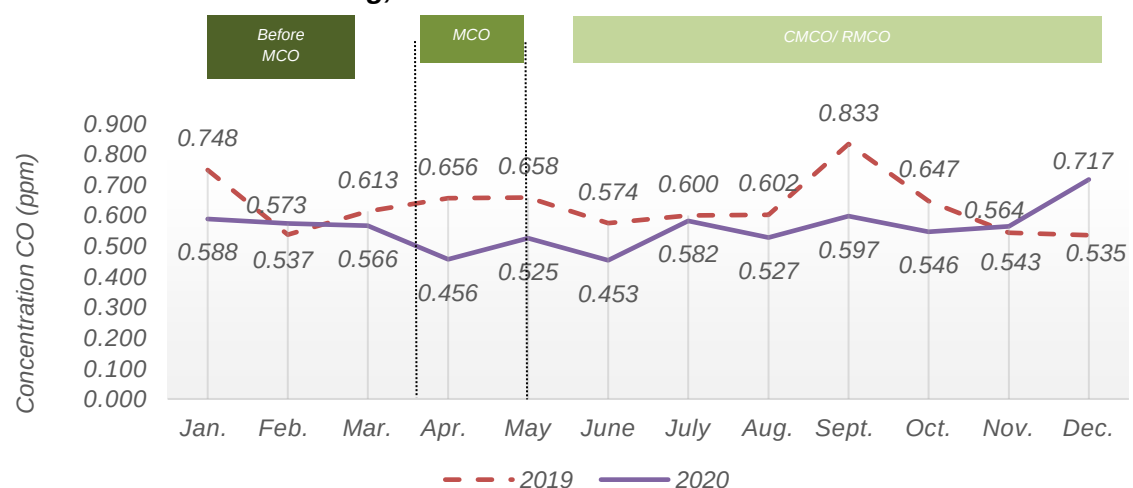


Chart 1.16: Monthly average concentration of CO in the air, USM station, Pulau Pinang, 2019 and 2020





Sulphur Dioxide (SO₂)

SO₂ is colourless, water-soluble reactive gas with an irritating odour. Excessive exposure to high concentration of SO₂ in the atmosphere causes respiratory illnesses and complications of cardiovascular problems.

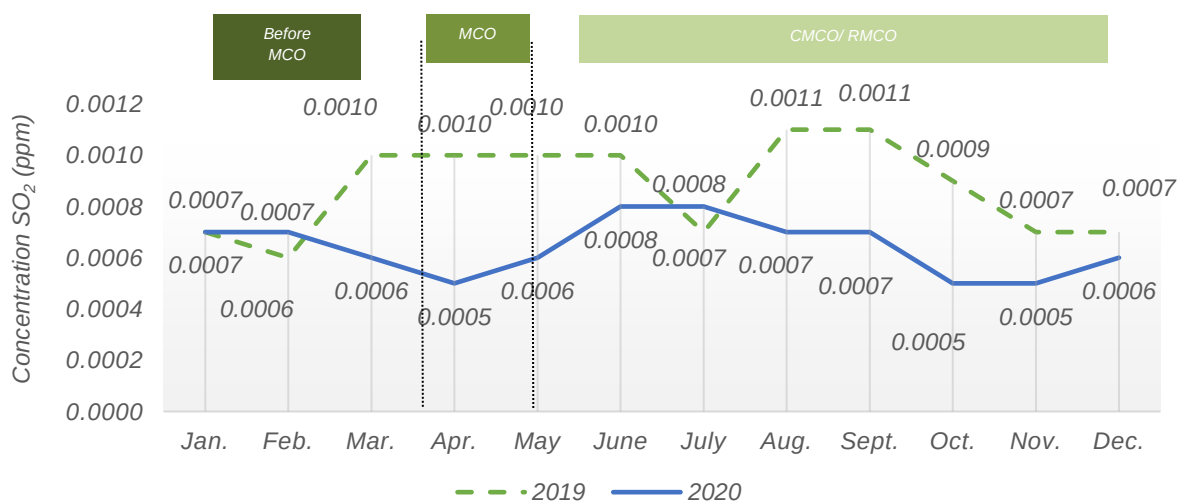
The monthly average trend concentration of SO₂ in the air during the implementation of MCO in 2020 declined as compared to 2019 except in May, July, August and November 2020 (Balik Pulau); July 2020 (Perai); October and December 2020 (Seberang Jaya); August 2020 (USM).

Chart 1.17: Monthly average concentration of SO₂ in the air, Balik Pulau station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

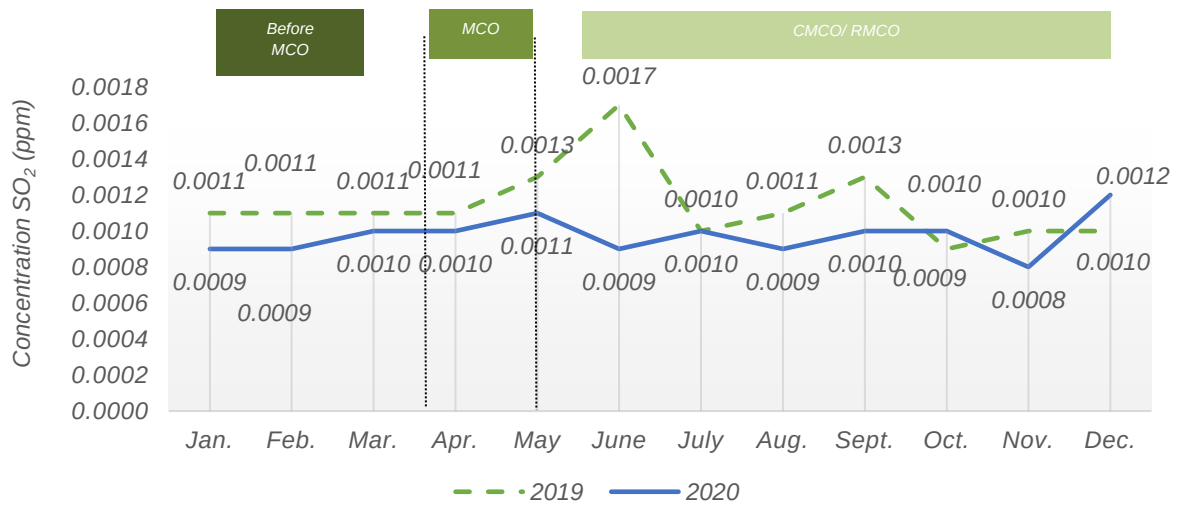
Chart 1.18: Monthly average concentration of SO₂ in the air, Perai station, Pulau Pinang, 2019 and 2020



Source: Department of Environment



Chart 1.19: Monthly average concentration of SO₂ in the air, Seberang Jaya station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

Chart 1.20: Monthly average concentration of SO₂ in the air, USM station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

Nitrogen Dioxide (NO₂)

NO₂ is formed in the ambient air through the oxidation of Nitrogen Monoxide (NO). This reddish brown toxic gas has a sharp and pungent odour.

All stations in Penang showed a decrease in the monthly average concentration of NO₂ in the air in 2020 as compared to 2019.



Chart 1.21: Monthly average concentration of NO₂ in the air, Balik Pulau station, Pulau Pinang, 2019 and 2020

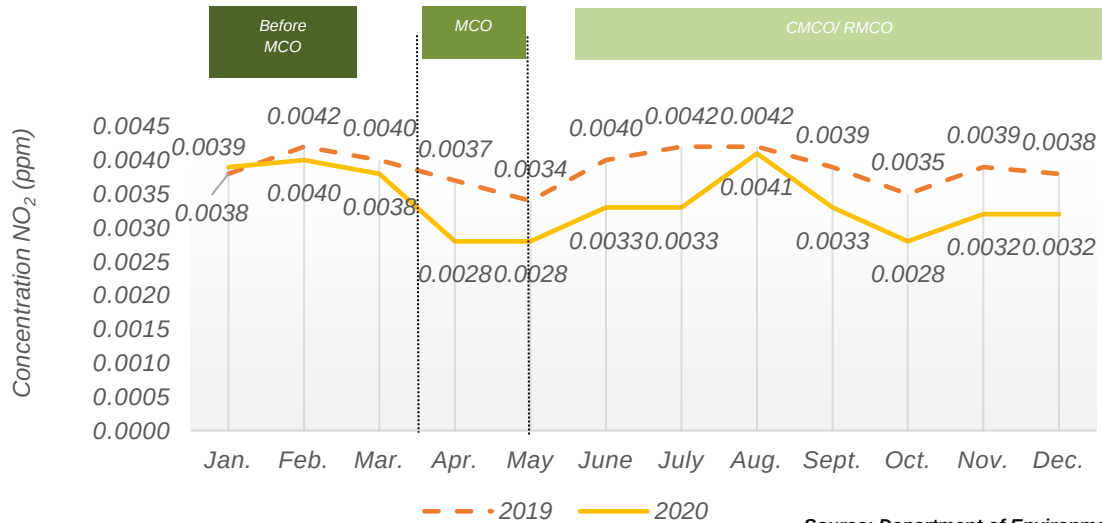


Chart 1.22: Monthly average concentration of NO₂ in the air, Seberang Perai station, Pulau Pinang, 2019 and 2020

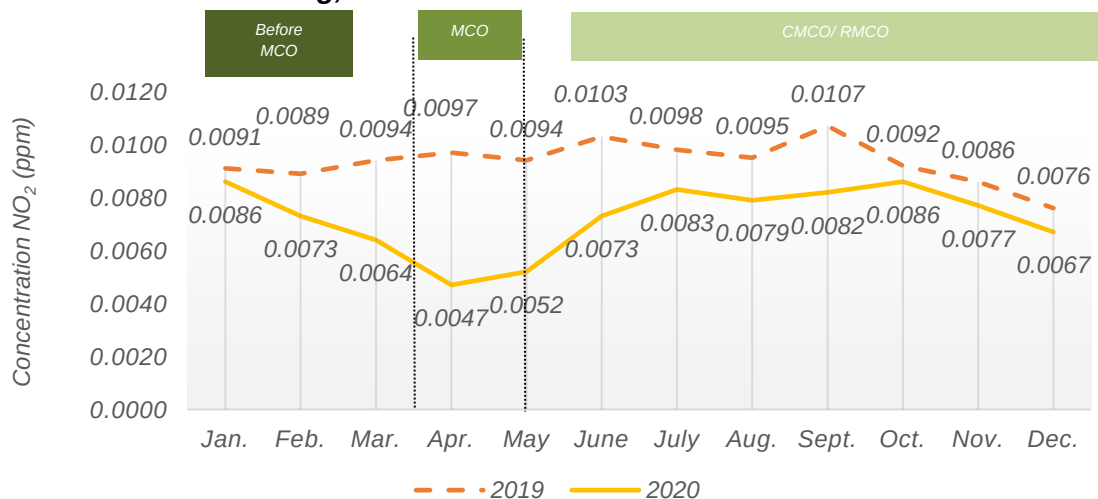


Chart 1.23: Monthly average concentration of NO₂ in the air, Seberang Jaya station, Pulau Pinang, 2019 and 2020

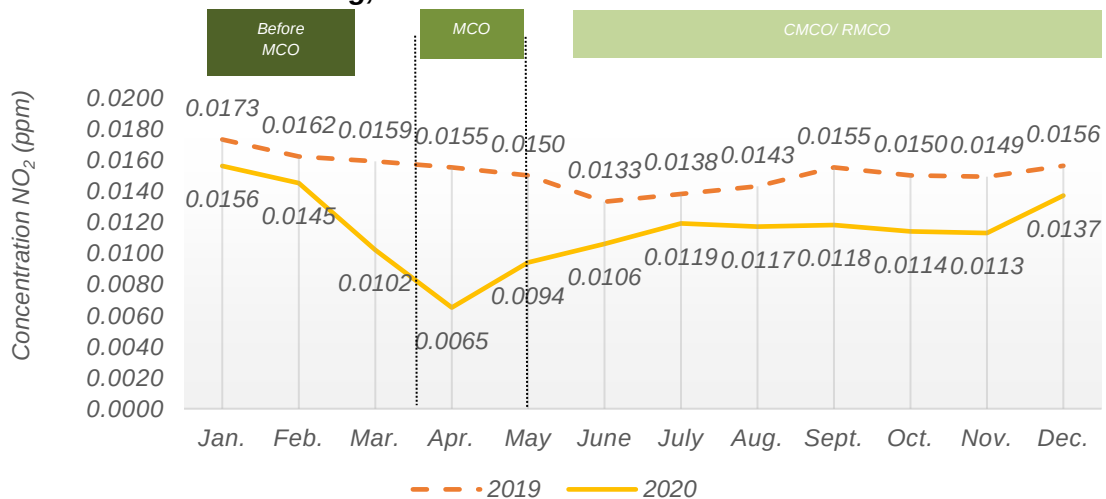
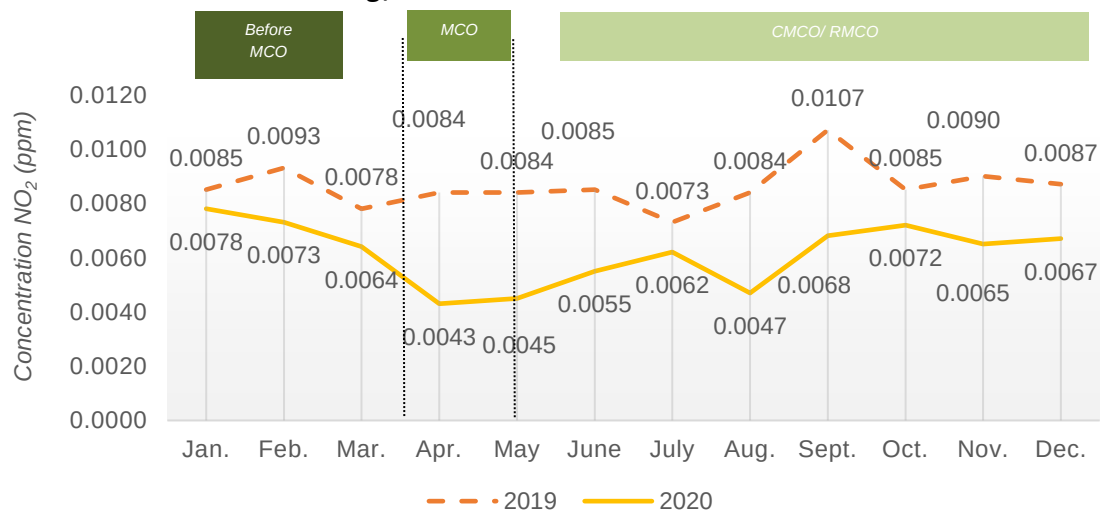




Chart 1.24: Monthly average concentration of NO₂ in the air, USM station, Pulau Pinang, 2019 and 2020



Source: Department of Environment

B. Mean temperature, rainfall and mean relative humidity

Malaysia's climate is categorised as equatorial, has a uniform temperature, copious rainfall and humid throughout the year. This climate is influenced by the Northeast monsoon and Southwest monsoon. Northeast monsoon blows from November to March, while the Southwest monsoon from May to September. The east coast of Peninsular Malaysia and the coastal areas of Sabah and Sarawak are strongly influenced by the Northeast monsoon season. However, the west coast of Peninsular Malaysia is not affected because it is protected by the soaring mountain ranges.

Pulau Pinang has two meteorological stations to monitor the weather conditions continuously and provide meteorological data which are used in weather forecasting. The stations are Bayan Lepas and Butterworth.

Mean temperature

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Exhibit 1.1: Mean temperature at meteorological stations, Pulau Pinang, 2019 and 2020

2019		Meteorological stations	2020	
Max.	Min.		Max.	Min.
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32.4°C	24.7°C	Butterworth	32.1°C	24.8°C

Source: Department of Environment

Rainfall distribution

Butterworth station recorded the highest annual rainfall in 2020 at 2,160.8 mm compared to the previous year (2,158.9 mm). However, Bayan Lepas station recorded the lowest annual rainfall of 1,831.2 mm in 2020 compared to the previous year (1,740.2 mm).

[Exhibit 1.2]

Exhibit 1.2: Total and number of rainfall days at meteorological stations, Pulau Pinang, 2019 and 2020

2019		Meteorological stations	2020	
Total (mm)	No. of days		Total (mm)	No. of days
1,740.2	153	Bayan Lepas	1,831.2	167
2,158.9	158	Butterworth	2,160.8	187

Source: Department of Environment

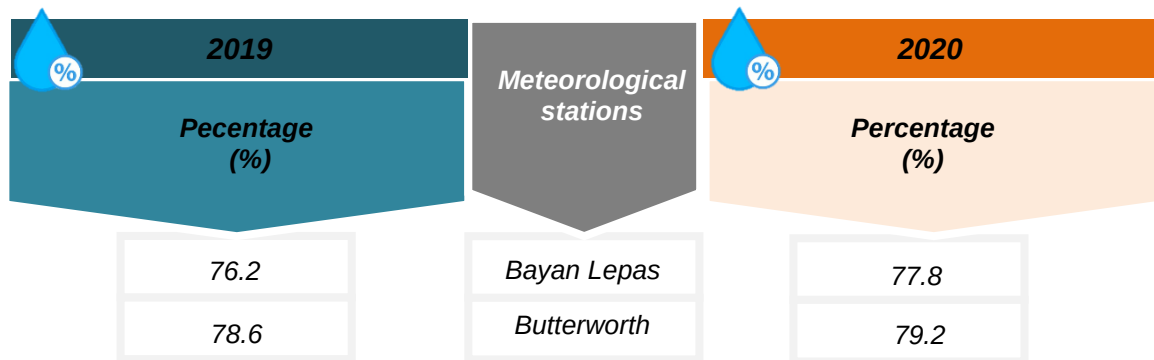
Mean relative humidity

The mean relative humidity in Pulau Pinang was between 79.2 per cent (Butterworth) and 77.8 per cent (Bayan Lepas) in 2020. However, this reading decreased compared to 2019 which is between 78.6 per cent (Butterworth) and 76.2 per cent (Bayan Lepas).

[Exhibit 1.3]



Exhibit 1.3: Mean relative humidity at meteorological stations, Pulau Pinang, 2019 and 2020



Source: Department of Environment

C. Air quality status

Air is the mixture of gases which make up the earth's atmosphere. It is mainly composed of nitrogen (about 78.0%), oxygen (about 21.0%) and other gases (about 1.0%). Air is essential for life as we use it to burn fuels for heating, transportation, power generation and others.

Air Pollution Index

The Department of Environment (DOE) monitors the country's ambient air quality through 65 monitoring stations that are located throughout the country to monitor and to detect any significant change in the air quality that can contribute to the negative impact to human health and the environment.

The status of air quality in Malaysia is reported as the Air Pollutant Index (API). The air pollutants used in computing the API are Ozone (O_3), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO₂), Particulate Matter of less than 10 microns in size (PM_{10}) and Particulate Matter of less than 2.5 microns in size ($PM_{2.5}$).

Status of Air Pollution Index (API)

API	API Status
0-50	Good
51-100	Moderate
101-200	Unhealthy
201-300	Very Unhealthy
>300	Hazardous



During the implementation of the MCO, Pulau Pinang in overall recorded a “good” and “moderate” air quality status for 2020. USM station recorded the highest number of days (114 days) with “good” air quality in 2020 as compared to 50 days in the previous year. API reading showed a decrease in the air pollutants levels, especially in major cities across the state due to lower air pollutant emissions such as motor vehicles smoke, industrial chimney emissions and open burning activities. **[Exhibit 1.4]**

Exhibit 1.4: Status of air quality¹ by station, Pulau Pinang, 2019 and 2020

Exhibit 1.4: Status of air quality by station, Pulau Pinang, 2019 and 2020

						Number of days
Station	Year	Good (0-50)	Moderate (51-100)	Unhealthy (101-200)	Very Unhealthy (201-300)	Hazardous (>300)
Pulau Pinang						
Balik Pulau	2020	83	281	2	-	-
	2019	57	298	8	2	-
Perai	2020	77	289	-	-	-
	2019	44	317	4	-	-
Seberang Jaya	2020	36	330	-	-	-
	2019	30	330	5	-	-
USM	2020	114	252	-	-	-
	2019	50	305	8	2	-

¹Air quality status readings are based on daily maximum readings

Source: Department of Environment

D. Water resources

Water is very essential to human beings, socioeconomic activities such as industrial activities, aquaculture, transportation, agriculture and generation of energy. Malaysia has an abundant rainfall and an extensive river system as national water resources. The water demand has increased as the population grows and improvements in the standard of living. Water shortage should be overcome since it would affect human and economic activities. As such, the management of water resources should be addressed in order to meet the increasing demand.

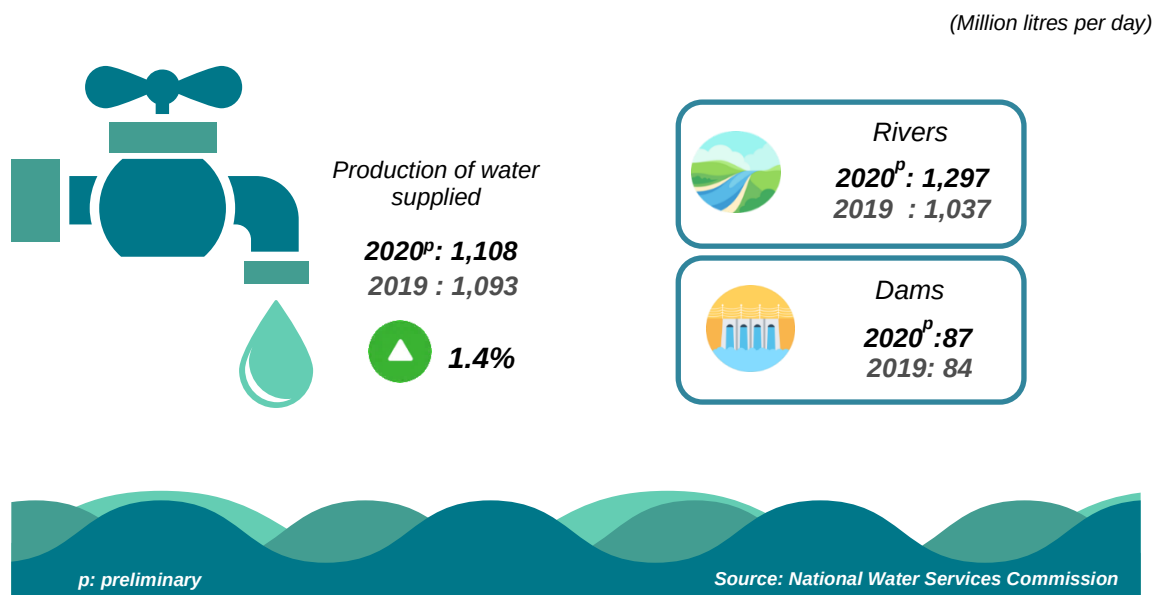
Water resources are resources acquired for human consumption and the environment comprising rivers, lakes, groundwater, seawater and other sources.

In Malaysia, 97.0 per cent of water supply is from surface water while the remaining is from groundwater. Groundwater is an alternative source of water, especially in areas where surface water supply is inadequate or unavailable.



The source of abstracted raw water supply in Pulau Pinang are from rivers and dams. In 2020, the total of abstracted raw water supply is 1,384 million litres per day (MLD) where rivers account for 93.7 per cent while the rest is from dams. Volume production of water supplied in Pulau Pinang was 1,108 MLD in 2020, an increase of 1.4 per cent as compared to 1,093 MLD recorded in 2019. **[Exhibit 1.5]**

Exhibit 1.5: Production of water supplied and supply of abstracted raw water by source, Pulau Pinang, 2019 and 2020



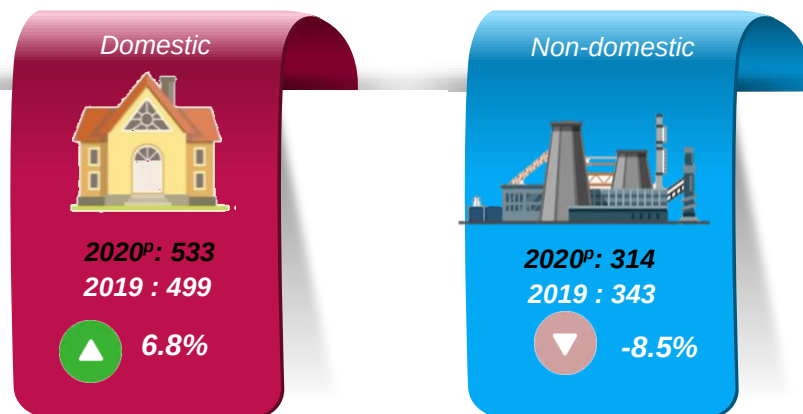
The domestic sector refers to water used by households to carry out daily activities such as washing dishes, cooking, washing clothes, bathing, watering plants and others. Meanwhile, the non-domestic sector refers to water used for commercial, industrial and general use in agriculture and livestock.

The increase in water consumption for the domestic sector in Malaysia is in line with the implementation of the MCO in 2020 as more Malaysians worked from home. Meantime, metered water consumption for the domestic category Pulau Pinang also showed an increase of 6.8 per cent and non-domestic decreased by 8.5 per cent in 2020 as compared to 2019. **[Exhibit 1.6]**



Exhibit 1.6: Metered water consumption by sector, Pulau Pinang, 2019 and 2020

(Million litres per day)



Source: National Water Services Commission

E. Clinical waste

Clinical waste refers to any waste which consists wholly or partly of human tissues, blood or body fluids, excretions, drugs or pharmaceutical products and others. It is classified as scheduled waste under the First Schedule Environmental Quality (Scheduled Wastes) Regulations, 2005.

The COVID-19 pandemic had a direct impact on clinical waste due to the use of personal protective equipment (PPE) and COVID-19 test equipment in the handling of COVID-19 patients in health facilities and quarantine centers. Pulau Pinang also recorded 3,336.0 metric tonnes of clinical waste in 2020 as compared to 2,360.3 metric tonnes recorded in 2019. [Exhibit 1.7]

Exhibit 1.7: Quantity of clinical waste, Pulau Pinang, 2019 and 2020

(Metric tonnes)



Source: Department of Environment

ARTIKEL

ARTICLES



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Taburan hujan di Pulau Pinang, 1995-2020

Pengenalan

Perubahan iklim dunia mutakhir ini banyak mempengaruhi corak dan taburan hujan sama ada pada skala tempatan mahupun global. *Intergovernmental Panel on Climate Change* (IPCC) pada tahun 2007 melaporkan bahawa telah berlaku peningkatan terhadap jumlah hujan di bahagian atau kawasan yang terletak di latitud 30° U dari tahun 1900 hingga 2005. Sementara itu, berlaku pula pengurangan terhadap jumlah hujan yang turun di kawasan tropika sejak tahun 1970-an.

Iklim Malaysia

Malaysia terletak di zon khatulistiwa dan mengalami iklim panas dan lembap. Pada amnya, ia mempunyai suhu seragam, kelembapan tinggi dan hujan yang banyak. Walaupun tiupan angin di Malaysia pada amnya lemah dan terdapat perubahan bertempoh dalam corak tiupan angin. Berdasarkan kepada perubahan ini, empat musim boleh dibezakan iaitu monsun Timur Laut (November-Mac), monsun Barat Daya (Mei-September) dan dua musim peralihan monsun (Mac-Mei & Oktober-November) yang lebih pendek¹.

Taburan Hujan

Corak tiupan angin bermusim bersama sifat topografi lokal menentukan corak taburan hujan di Malaysia. Semasa musim timur laut, kawasan yang terdedah seperti kawasan Pantai Timur Semenanjung Malaysia, kawasan Barat Sarawak dan kawasan Pantai Timur Laut Sabah mengalami beberapa tempoh hujan lebat. Sebaliknya, kawasan pendalaman atau kawasan yang dilindungi banjaran gunung adalah secara relatifnya bebas dari pengaruh ini.

Penemuan

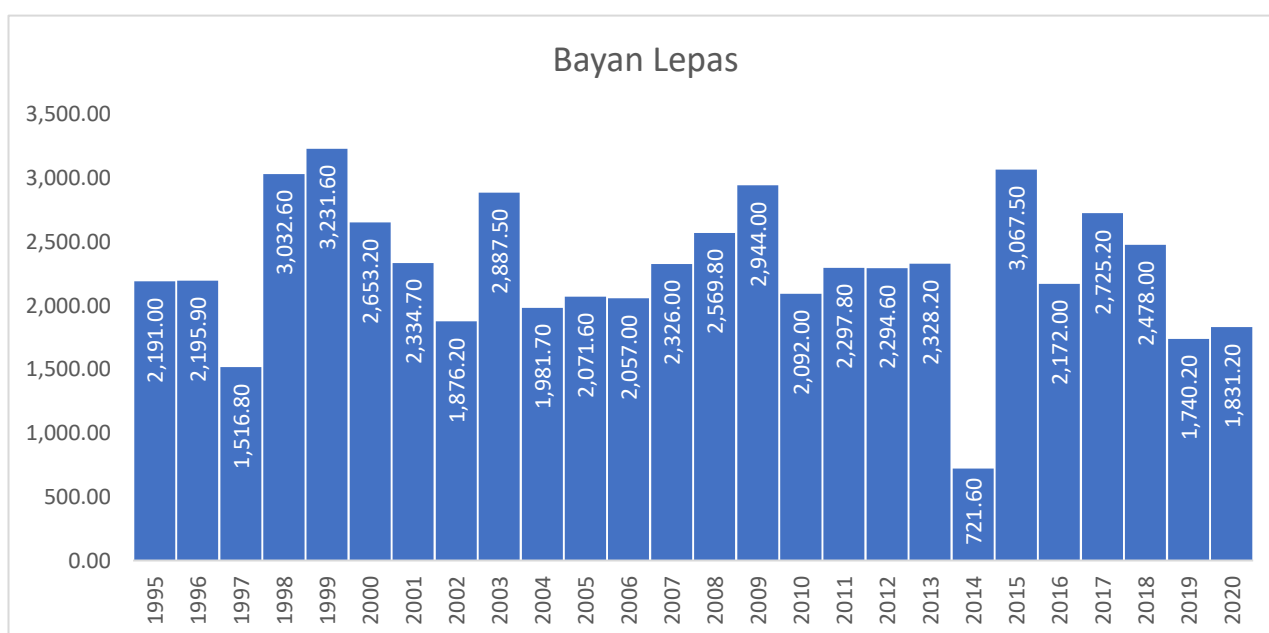
Kajian dan analisis taburan hujan tahunan adalah bertujuan untuk melihat trend taburan hujan berdasarkan perubahan iklim dan musim di negeri Pulau Pinang. Selain itu, hasil kajian boleh digunakan dalam merangka pengurusan kepada penggunaan air di Pulau Pinang bagi mengenalpasti sumber air dan kitarannya. Pulau Pinang mempunyai dua stesen meteorologi berperanan untuk mengawasi keadaan cuaca secara berterusan dan menyediakan data

¹ Portal Jabatan Meteorologi Malaysia, www.met.gov.my

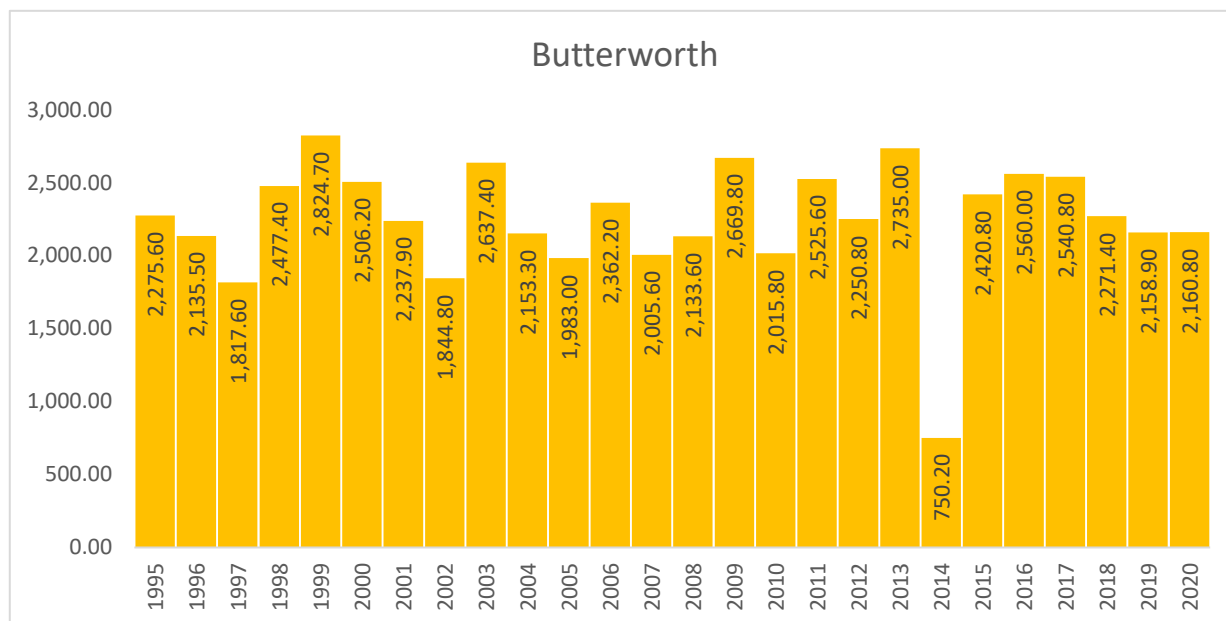
meteorologi untuk kegunaan ramalan cuaca. Stesen-stesen tersebut adalah Bayan Lepas dan Butterworth. Rekod taburan hujan kawasan kajian daripada dua buah stesen Jabatan Meteorologi Malaysia selama 26 tahun (1995 hingga 2020) telah dikumpulkan dan dianalisis mengikut jumlah hujan tahunan seperti yang ditunjukkan dalam Carta 1.1 dan 1.2. Berdasarkan kajian, perubahan peratusan tahunan taburan hujan di stesen Bayan Lepas mencatatkan penurunan tertinggi sebanyak 16.4 peratus dan diikuti stesen Butterworth 5.0 peratus.

Jumlah hujan tahunan di stesen meteorologi Bayan Lepas dari tahun 1995 hingga 2020 ditunjukkan dalam Carta 1.1. Jumlah hujan tahunan terendah direkodkan pada tahun 2014 iaitu 721.6 mm dan tertinggi pada tahun 1999 iaitu 3,231.6 mm. Purata hujan tahunan di stesen berkenaan untuk jangka masa tersebut adalah 2,293.0 mm. Rekod juga menunjukkan 76.9 peratus (20 tahun) jumlah hujan yang sentiasa melebihi 2000 mm setiap tahun kecuali tahun 2014 (721.6 mm), 1997 (1,516.8 mm), 2019 (1,740.2 mm), 2020 (1,831.2 mm), 2002 (1,876.2 mm) dan 2004 (1,981.7 mm).

Carta1.1: Taburan hujan di stesen meteorologi Bayan Lepas, Pulau Pinang, 1995-2020



Jumlah hujan tahunan di stesen meteorologi Butterworth dari tahun 1995 hingga 2020 ditunjukkan dalam Carta 1.2. Jumlah hujan tahunan terendah direkodkan pada tahun 2014 iaitu 750.2 mm dan tertinggi pada tahun 1999 iaitu 2,824.7 mm. Purata hujan tahunan di stesen berkenaan untuk jangka masa tersebut adalah 2,248.26 mm. Rekod juga menunjukkan 84.6 peratus (22 tahun) jumlah hujan yang sentiasa melebihi 2,000 mm setiap tahun kecuali tahun 2014 (750.2 mm), 1997 (1,817.6 mm), 2002 (1,844.8 mm) dan 2005 (1,983.0 mm).

Carta 1.2: Taburan hujan di stesen meteorologi Butterworth, Pulau Pinang, 1995 - 2020

Kesimpulan

Penelitian terhadap trend hujan dalam tempoh masa tertentu adalah penting dan relevan dalam kajian hidrologi khususnya sebagai alat untuk mengesan dan mengenal pasti perubahan yang berlaku ke atas pelbagai sumber air untuk perancangan dan pengurusan (Xia et al., 2004). Maklumat berkaitan trend hujan yang jelas boleh dijadikan satu indikator peramalan dalam perancangan mengatasi masalah banjir besar atau masalah kekurangan hujan yang dikaitkan dengan kejadian kemarau. Perubahan corak taburan hujan yang berlaku pada skala tempatan dan global serta tahap kepentingan yang tinggi diperlukan untuk menilai trend taburan hujan bagi tujuan tertentu. Ini menunjukkan bahawa sifat dan ciri-ciri iklim di sesuatu kawasan adalah berbeza daripada kawasan lain kerana perbezaan aspek geografi. Selain itu, aspek masa juga mempengaruhi sifat dan ciri-ciri iklim sesuatu kawasan yang turut dikaitkan dengan perubahan global dan tindakan manusia.

Malaysia ialah negara yang dikurniakan taburan jumlah hujan yang banyak, mencapai sehingga 970 bilion meter padu setahun. Peningkatan terhadap permintaan air, khususnya pada musim kering atau kemarau menyebabkan gangguan bekalan air terawat sering berlaku. Isu ini boleh membangkitkan risiko terhadap pembangunan negara, kelestarian air dan kualiti hidup rakyat. Bagi mengatasi masalah tersebut, selain pada masa yang sama mengurangkan kebergantungan kepada bekalan air domestik, Kementerian Alam Sekitar dan Air (KASA)

melalui Pelan Pelestarian Alam Sekitar di Malaysia 2020-2030 menetapkan sasaran secara progresif bermula 2021 untuk mencapai 100 juta liter sehari (JLH) penuaian air hujan dan 3,000 JLH takungan air bawah tanah pada 2030. Sasaran ini akan dicapai melalui pembangunan mekanisme simpanan air hujan sebagai air minuman dan kegunaan domestik, selain pembangunan kemudahan simpanan air bawah tanah untuk pertanian dan industri.²

² Bersama Memakmur Bumi (penerbitan oleh KASA)

Rainfall distribution in Pulau Pinang, 1995-2020

Introduction

Recently global climate change has significantly affected the patterns and distribution of rainfall both locally and globally. The Intergovernmental Panel on Climate Change (IPCC) in 2007 reported that there had been an increase in rainfall in parts or areas located at latitude 30° N from 1900 to 2005. Meanwhile, there had been a decrease in rainfall in the tropics since the 1970s.

Climate of Malaysia

Malaysia is located in the equatorial zone and experiences a hot and humid climate. In general, it has a uniform temperature, high humidity and abundant rainfall. Although wind gusts in Malaysia are generally weak and there are periodic changes in wind gust patterns. Based on these changes, four seasons can be distinguished namely Northeast monsoon (November-March), Southwest monsoon (May-September) and two shorter monsoon transition seasons (March-May & October-November)¹.

Rainfall

Seasonal wind patterns together with the nature of the local topography determine the pattern of rainfall distribution in Malaysia. During the northeast season, exposed areas such as the East Coast of Peninsular Malaysia, West Sarawak and the northeast coast of Sabah experience several periods of heavy rainfall. In contrast, inland areas or mountain range protected areas are relatively free from this influence.

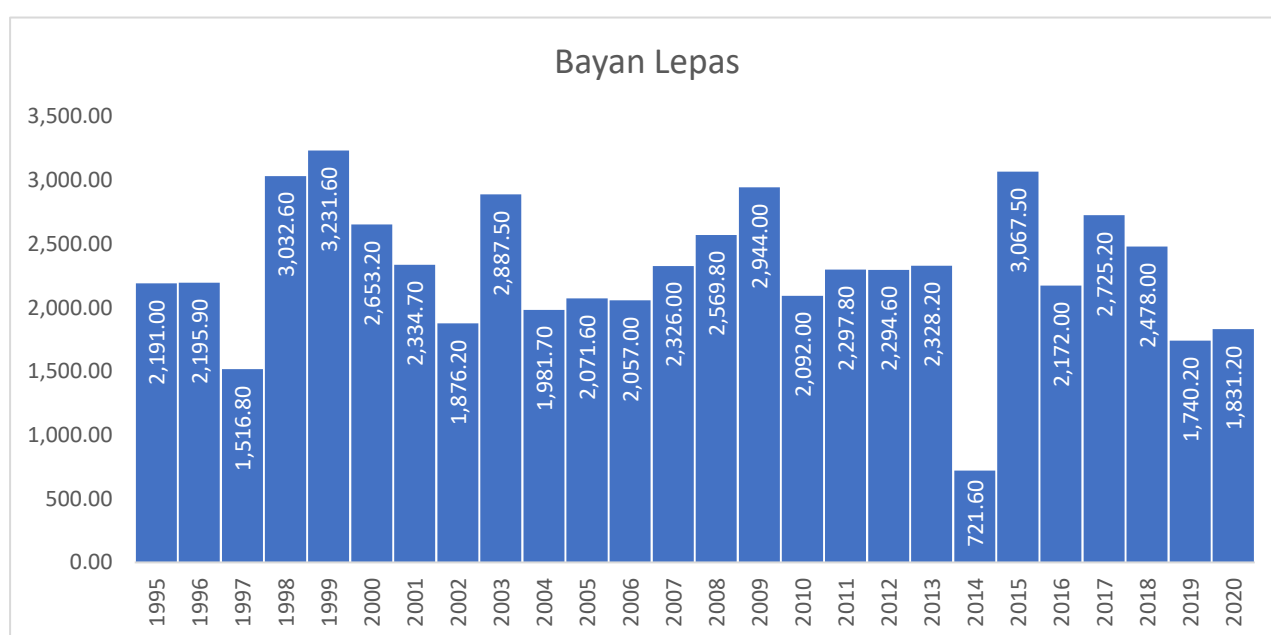
¹ Malaysian Meteorological Department Portal, www.met.gov.my

Discovery

The study and analysis of annual rainfall distribution aims to see the trend of rainfall distribution based on climate change and seasons in the state of Pulau Pinang. In addition, the results of the study can be used in formulating management of water use in Pulau Pinang to identify water resources and its cycle. Pulau Pinang has two meteorological stations that monitoring the weather conditions continuously and provide meteorological data for weather forecast use. The stations are Bayan Lepas and Butterworth. Rainfall distribution records of the study area from two stations of the Malaysian Meteorological Department for 26 years (1995 to 2020) were collected and analyzed according to the annual rainfall as shown in Chart 1.1 and 1.2. Based on the study, the change in the annual percentage of rainfall distribution at Bayan Lepas station showed the highest decline 16.4 per cent. On the other hand, Butterworth station registered a decrease of 5.0 per cent.

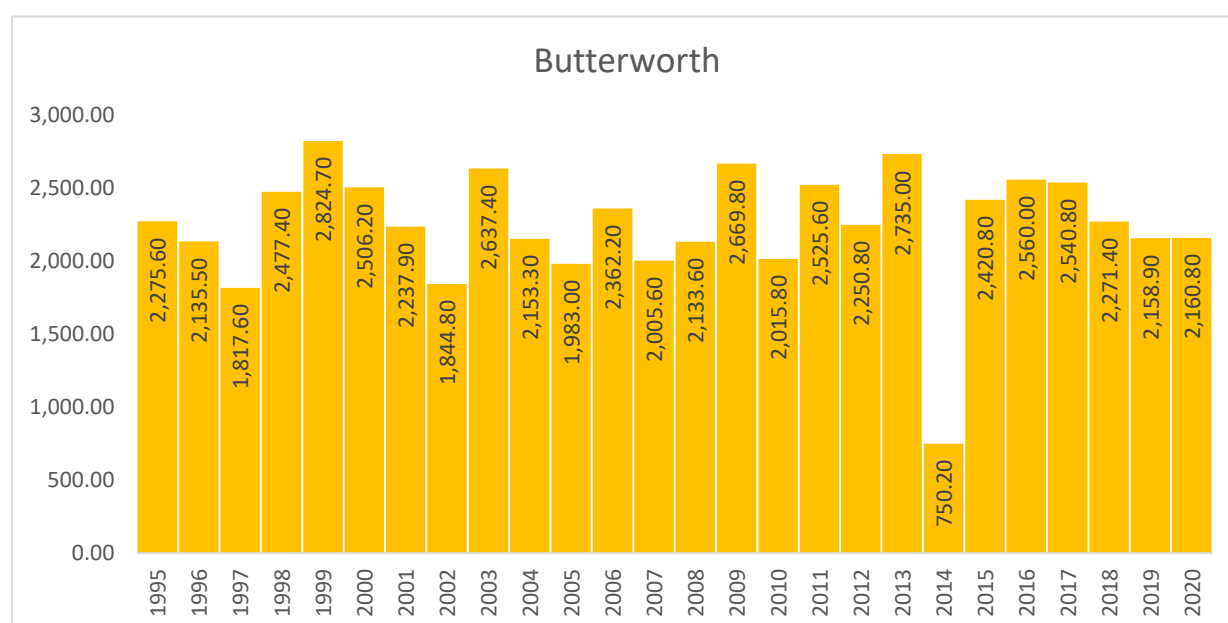
The total annual rainfall at the Bayan Lepas meteorological station from 1995 to 2020 is shown in Chart 1.1. The lowest annual rainfall was recorded in 2014 at 721.6 mm and the highest was in 1999 at 3,231.6 mm. The average annual rainfall at the station for the period was 2,293.00 mm. Records also showed 76.9 per cent (20 years) of total rainfall which always exceeded 2,000 mm per year except 2014 (721.6 mm), 1997 (1,516.8 mm), 2019 (1,740.2 mm), 2020 (1,831.2 mm), 2002 (1,876.2 mm) and 2004 (1,981.7 mm).

Chart 1.1: Rainfall distribution at Bayan Lepas meteorological station, Pulau Pinang, 1995-2020



The total annual rainfall at the Butterworth meteorological station from 1995 to 2020 is shown in Chart 1.2. The lowest annual rainfall was recorded in 2014 at 750.2 mm and the highest was in 1999 at 2,824.7 mm. The average annual rainfall at the station for the period was 2,248.26 mm. Records also show 84.6 per cent (22 years) of total rainfall always exceeded 2,000 mm per year except 2014 (750.2 mm), 1997 (1,817.6 mm), 2002 (1,844.8 mm) and 2005 (1,983.0 mm).

Chart 1.2: Rainfall distribution at Butterworth meteorological station, Pulau Pinang, 1995-2020



Conclusion

The study of rainfall trends in a particular period is important and relevant in hydrological studies especially as a tool to detect and identify changes that occur in various water resources for planning and management (Xia et al., 2004). Information related to clear rainfall trends can be used as a forecasting indicator in planning to overcome major floods or the lack of rainfall associated with droughts. Changes in rainfall patterns that occur on a local and global scale as well as a high level of importance are required to assess rainfall distribution trends for specific purposes. This shows that the nature and characteristics of climate in one area is different from in other places due to differences in geographical aspects. In addition, the aspect of time also influences the nature and characteristics of the climate of an area which is also associated with global change and human action.

Malaysia is a country endowed with a large distribution of rainfall, reaching up to 970 billion cubic meters per year. Increases in water demand, especially during the dry season or drought cause disruption of treated water supply to occur frequently. This issue can pose risks to national development, water sustainability and the quality of life of the people. To overcome the problem, besides at the same time reducing dependence on domestic water supply, the Ministry of Environment and Water (KASA) through the Environmental Conservation Plan in Malaysia 2020-2030 set a target progressively starting 2021 to reach 100 million liters per day (MLD) rainwater harvesting and 3,000 MLD of groundwater reservoirs by 2030. This target will be achieved through the development of rainwater storage mechanisms as drinking water and domestic use, as well as the development of groundwater storage facilities for agriculture and industry².

² Bersama Memakmur Bumi (*publication by KASA*)

JADUAL STATISTIK

STATISTICAL TABLES



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Jadual 1.1: Purata suhu, volum hujan dan purata kelembapan relatif, Pulau Pinang, 2016-2020

Table 1.1: Mean temperature, rainfall volume and mean relative humidity, Pulau Pinang, 2016-2020

Stesen meteorologi (ketinggian dari purata paras laut dalam me- ter) Meteorological station (height above mean sea level in metres)	Tahun Year	Purata suhu (°C) Mean temperature		Hujan Rainfall		Purata kelembapan relatif Mean relative humidity (%)
		Min.	Maks. Max.	Jumlah Total (mm)	Bil. hari No. of days	
Bayan Lepas (2.5 m)	2016	24.9	32.0	2,172.0	159	77.4
	2017	25.0	31.9	2,725.2	183	79.1
	2018	25.1	32.2	2,478.0	189	77.6
	2019	25.5	32.7	1,740.2	153	76.2
	2020	25.4	32.2	1,831.2	167	77.8
Butterworth (3.3 m)	2016	24.8	32.1	2,560.0	178	79.4
	2017	25.1	32.1	2,540.8	171	81.5
	2018	24.6	31.9	2,271.4	190	79.7
	2019	24.7	32.4	2,158.9	158	78.6
	2020	24.8	32.1	2,160.8	187	79.2

Sumber: Jabatan Meteorologi Malaysia
Source: Malaysia Meteorological Department

Jadual 1.2: Purata bulanan tekanan aras laut, Pulau Pinang, 2020

Table 1.2: Monthly mean sea level pressure, Pulau Pinang, 2020

hPa

Stesen Station	Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Bayan Lepas	1,010.5	1,011.1	1,009.8	1,009.9	1,008.8	1,009.0	1,008.6	1,008.6	1,009.3	1,008.8	1,009.6	1,009.3
Butterworth	1,010.5	1,011.0	1,009.7	1,009.8	1,008.7	1,008.8	1,008.6	1,008.4	1,009.2	1,008.7	1,009.5	1,009.3

Sumber: Jabatan Meteorologi Malaysia
Source: Malaysia Meteorological Department

Jadual 1.3: Purata bulanan kelajuan angin permukaan, Pulau Pinang, 2020

Table 1.3: Monthly mean surface wind speed, Pulau Pinang, 2020

m/s

Stesen Station	Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Bayan Lepas	2.6	2.8	2.2	2.1	2.0	2.0	2.1	1.9	1.9	1.4	1.8	2.4
Butterworth	2.4	2.5	2.5	2.1	2.0	2.1	2.1	2.0	2.2	2.0	1.9	2.1

Sumber: Jabatan Meteorologi Malaysia
Source: Malaysia Meteorological Department

Jadual 1.4: Purata bulanan sinaran global, Pulau Pinang, 2020

Table 1.4: Monthly mean global radiation, Pulau Pinang, 2020

MJ/m²

Stesen Station	Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Bayan Lepas	20.95	22.02	22.59	20.77	18.07	18.57	17.82	19.55	17.16	15.68	15.74	16.79

Sumber: Jabatan Meteorologi Malaysia
Source: Malaysia Meteorological Department

Jadual 1.5: Purata bulanan penyejatan, Pulau Pinang, 2020

Table 1.5: Monthly mean evaporation, Pulau Pinang, 2020

mm

Stesen Station	Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Bayan Lepas	4.4	5.1	4.8	3.9	3.1	3.4	3.2	3.5	3.0	2.5	2.2	2.7

Sumber: Jabatan Meteorologi Malaysia
Source: Malaysia Meteorological Department

Jadual 1.6: Bacaan maksimum harian Indeks Ultra Ungu (UV), Bayan Lepas, 2020

Table 1.6: Daily maximum reading of the Ultra Violet (UV) Index, Bayan Lepas, 2020

Stesen/Station	Bayan Lepas											
Bulan/Monthly Hari/Days	Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
1	10	Def.	11 +	11 +	10	11 +	9	11+	11+	11+	10	8
2	8	8	11 +	11 +	10	11 +	10	10	11+	7	6	10
3	11 +	9	11 +	11 +	11 +	Def.	7	11+	11+	11+	5	11 +
4	11 +	10	Def.	11 +	11 +	Def.	10	11+	10	11+	6	8
5	10	9	11 +	10	9	11 +	10	11+	11+	7	9	9
6	11 +	11 +	11 +	11 +	11 +	11 +	11 +	10	11+	11+	11+	8
7	Def.	10	10	11 +	11 +	10	7	11+	11+	3	11+	9
8	Def.	11 +	11 +	11 +	11 +	10	11 +	11+	11+	9	9	9
9	10	11 +	11 +	11 +	11 +	11 +	10	11+	11+	6	9	9
10	11 +	11 +	11 +	11 +	9	7	9	11+	11+	11+	11+	9
11	10	11 +	Def.	11 +	11 +	7	10	11+	7	11+	7	10
12	8	11 +	11 +	11 +	11 +	3	11 +	5	11+	8	10	9
13	9	11 +	11 +	11 +	11 +	11 +	7	11+	7	4	9	8
14	10	11 +	11 +	8	11 +	11 +	11 +	7	8	11+	10	10
15	9	11 +	11 +	11 +	11 +	10	11 +	11+	11+	11+	11+	10
16	10	11 +	11 +	11 +	10	11 +	8	11+	10	11+	11+	10
17	10	11 +	10	8	3	11 +	11 +	11+	11+	11+	10	8
18	10	Def.	11 +	11 +	11 +	11 +	11 +	11+	6	11+	11+	7
19	11 +	11 +	11 +	11 +	11 +	7	11 +	11+	11+	10	10	9
20	11 +	11 +	11 +	11 +	10	11 +	11 +	11+	11+	11+	10	4
21	10	11 +	10	11 +	10	11 +	10	8	11+	11+	8	8
22	11 +	11 +	11 +	11 +	3	11 +	11 +	11+	11+	5	9	10
23	11 +	11 +	11 +	11 +	9	11 +	11 +	11+	11+	11+	11+	9
24	Def.	11 +	11 +	11 +	11 +	11 +	11 +	11+	11+	11+	6	10
25	11 +	11 +	11 +	11 +	11 +	11 +	11 +	11+	11+	11+	8	10
26	10	11 +	Def.	10	9	10	11 +	11+	11+	5	8	4
27	11 +	11 +	11 +	11 +	8	11 +	11 +	11+	10	11+	8	10
28	11 +	11 +	11 +	11 +	9	9	11 +	11+	7	9	10	10
29	9	11 +	11 +	11 +	11 +	10	11 +	11+	11+	6	8	10
30	10		11 +	10	11 +	10	10	11+	11+	11+	9	10
31	7		11 +		11 +		3	11+		10		10

Nota:

Notes

Def. **Nilai Defective**
Defective value

n.a. **Tiada pencerapan data disebabkan masalah instrumentasi**
No data observation due to instrumentation problems

Sumber: Jabatan Meteorologi Malaysia

Source: Malaysia Meteorological Department

Status Indeks Ultra Ungu (UV)

Ultra Violet Index (UV) status

0 to 2	Rendah / Low
3 to 5	Sederhana / Moderate
6 to 7	Tinggi / High
8 to 10	Sangat Tinggi / Very High
11+	Melampau / Extreme

Jadual 1.7: Senarai lembangan sungai utama di Pulau Pinang

Table 1.7: List of major river basins in Pulau Pinang

Bil. No.	Nama Lembangan sungai <i>River basins name</i>	Luas (km ²) <i>Area</i>	Kategori <i>Category</i>	Negeri/Negara <i>State/Country</i>
1.	Sg. Juru	80.76	1	Pulau Pinang
2.	Sg. Perai	447.82	2	Pulau Pinang/Kedah
3.	Sg. Jawi	231.03	2	Pulau Pinang/Kedah
4.	Sg. Kerian	1,420.23	2	Pulau Pinang/Kedah/Perak
5.	Sg. Muda	4,150.40	2	Kedah/Pulau Pinang

Sumber: Jabatan Pengairan dan Saliran
Source: Department of Irrigation and Drainage

Nota:

Notes:

Kajian Persempadanan Lembangan Sungai Malaysia Fasa I oleh Bahagian Pengurusan Lembangan Sungai (2009)
River Basin Malaysia Boundary Survey Phase I by the River Management Division (2009)

Kategori 1: Lembangan sungai dalam 1 negeri

Category 1: River basin within the state

Kategori 2: Lembangan sungai melibatkan lebih dari 1 negeri

Category 2: River basin shared with more than 1 state

Lembangan sungai utama: Lembangan yang berkeluasan melebihi 80 km²

Main river basins: An area of over 80 km²

Jadual 1.8: Panjang pesisiran pantai, Pulau Pinang, 2020

Table 1.8: Coastal length, Pulau Pinang, 2020

Negeri <i>State</i>	Panjang pantai (km) <i>Coastal length</i>	Peratus <i>Per cent</i>
Malaysia	8,840.0	100.0
Pulau Pinang	215.6	2.4

Nota: National Coastal Erosion Study for Malaysia (2015)

Notes:

Sumber: Jabatan Pengairan dan Saliran

Source: Department of Irrigation and Drainage

Jadual 1.9: Empangan dan kolam takungan di Pulau Pinang

Table 1.9: Dams and reservoirs in Pulau Pinang

Bil. No.	Nama empangan (Tahun siap dibina) Name of dam (Year of completion)	Lokasi (Negeri) Location (State)	Empangan Dams				Kolam Takungan Reservoirs			
			Tinggi Height (m)	Panjang puncak Peak length (m)	Aras puncak Top peak (m)	Kawasan tadahan Catchment area (km ²)	Kapasiti Capacity (Mm ³)	Luahan alur limpah maksimum Maximum flood flow (cumeecs)	Luas per- mukaan Surface area (km ²)	Aras bi- asa Ordinary level (m)
1.	Air Hitam (1962)	Pulau Pinang	51.80	243.90	236.54	5.75	2.61	113.00	0.20	234.70
2.	Mengkuang (1985)	Pulau Pinang	46.34	1,005.00	45.34	3.90	23.60	430.00	1.74	43.30
3.	Teluk Bahang (1999)	Pulau Pinang	53.50	685.00	53.50	9.84	19.24	760.00	0.95	48.00
4.	Cherok To'Kun (1834)	Pulau Pinang	11.00	2.00	11.00	1.29	0.08	n.a.	0.10	10.00
5.	Berapit (1896)	Pulau Pinang	12.50	2.00	12.50	1.15	0.15	n.a.	2.10	12.00
6.	Bukit Panchor (1931)	Pulau Pinang	7.30	10.00	7.30	6.00	0.27	n.a.	0.50	5.80

Sumber: Jabatan Pengairan dan Saliran
Source: Department of Irrigation and Drainage

Jadual 1.10: Keluasan tanah, Pulau Pinang, 2021

Table 1.10: Land area, Pulau Pinang, 2021

Bil. No.	Negeri/ Daerah State/	Keluasan (km ²) Area
MALAYSIA		330,411.35
Pulau Pinang		1,049.07
1.	Seberang Prai Tengah (Bukit Mertajam)	237.8
2.	Seberang Prai Utara (Butterworth)	267.74
3.	Seberang Prai Selatan (Nibong Tebal)	242.27
4.	Timur Laut	126.40
5.	Barat Daya	174.87

Sumber: Jabatan Ukur dan Pemetaan Malaysia
Source: Department of Survey and Mapping Malaysia

Jadual 1.11: Kawasan perlindungan yang digazet, Pulau Pinang

Table 1.11: *Gazetted protected area, Pulau Pinang*

Kawasan perlindungan <i>Protected area</i>	Keluasan (Hektar) <i>Area (Hectares)</i>	Bilangan spesies <i>Number of species</i>				
		Fauna				
		Mamalia <i>Mammals</i>	Burung <i>Birds</i>	Reptilia <i>Reptiles</i>	Amfibia <i>Amphibians</i>	Moluska <i>Molluscs</i>
Taman Negara Pulau Pinang ²	2,563.0	52	174	14	15	-
Taman Botani Pulau Pinang	241.2	-	-	-	-	-

Kawasan perlindungan <i>Protected area</i>	Bilangan spesies <i>Number of species</i>					
	Fauna				Flora	
	Ikan <i>Fish</i>	Cnidarians	Spesis invertebrata yang lain ¹ <i>Other invertebrate species</i>	Rumpai laut <i>Seaweeds</i>	Rumput laut <i>Sea grass</i>	Tumbuhan <i>Plants</i>
Taman Negara Pulau Pinang ²	-	-	51	-	-	-
Taman Botani Pulau Pinang	-	-	-	-	-	-

Note:

Notes:

¹Lain-lain invertebrata seperti Serangga, Arthropods dan Echinoderms
Other invertebrates like Insects, Arthropods and Echinoderms

²Termasuk Taman Negara Pantai Aceh dan Pusat Konservasi Penyu Pantai Keranchut
Includes Taman Negara Pantai Aceh and Pusat Konservasi Penyu Pantai Keranchut

Meliputi maklumat daripada Jabatan Perlindungan Hidupan Liar dan Taman Negara, Jabatan Perhutanan Semenanjung Malaysia, Jabatan Perikanan, Perbadanan Negeri Perak, Perbadanan Taman Negeri Johor, Kerajaan Negeri Pulau Pinang dan Majlis Daerah Kuala Selangor.

Includes information from Department of Wildlife and National Parks, Department of Forestry Peninsular Malaysia, Department of Fisheries, Perak State Parks Corporation, Johor National Parks Corporation, Penang State Government and Kuala Selangor District Council.

- : Tidak diliputi oleh agensi semasa tahun rujukan Banci Kawasan Perlindungan dan Kepelbagaian Biologi 2014
Not covered by the agency during Biodiversity and Protected Areas Census 2014 reference year

Jadual 1.12: Kawasan berhutan dan tidak berhutan, Pulau Pinang, 2014-2018

Table 1.12: Forested and non-forested areas, Pulau Pinang, 2014-2018

Tahun Year	Berhutan Forested		Tidak Berhutan Non-Forested	
	Hektar Hectares	(%)	Hektar Hectares	(%)
2014	7,761	7.53	95,339	92.47
2015	7,761	7.53	95,339	92.47
2016	7,761	7.53	95,339	92.47
2017	7,761	7.53	95,343	92.47
2018	7,752	7.52	95,352	92.48

Sumber: Kementerian Tenaga dan Sumber Asli
Jabatan Perhutanan Semenanjung Malaysia
Source: Ministry of Energy and Natural Resources
Forestry Department Peninsular Malaysia,

Jadual 1.13: Keluasan hutan simpanan kekal, Pulau Pinang, 2014-2018

Table 1.13: Area of permanent reserved forest, Pulau Pinang, 2014-2018

Tahun Year	2014	2015	2016	2017 ²	Hektar Hectares 2018
Keluasan Area	6,060	6,060	6,060	5,101	5,101

Sumber: Kementerian Tenaga dan Sumber Asli
Jabatan Perhutanan Semenanjung Malaysia
Source: Ministry of Energy and Natural Resources
Forestry Department Peninsular Malaysia,

Nota:
Notes:

² Mulai 2017 pelaporan keluasan Hutan Simpanan Kekal (HSK) di Semenanjung Malaysia adalah berdasarkan keluasan HSK yang diwartakan sahaja (tidak termasuk cadangan HSK).

Since 2017, Permanent Reserve Forest (PRF) data in Peninsular Malaysia were reported based on gazetted PRF only (proposed PRF not included)

Jadual 1.14: Keluasan hutan paya laut mengikut negeri, Pulau Pinang, 2014-2018

Table 1.14: Area of mangrove forest by state, Pulau Pinang, 2014-2018

Tahun Year	2014	2015	2016	2017	Hektar Hectares 2018
Keluasan Area	1,045	1,045	1,045	381	381

Sumber: Kementerian Tenaga dan Sumber Asli
Jabatan Perhutanan Semenanjung Malaysia
Source: Ministry of Energy and Natural Resources
Forestry Department Peninsular Malaysia,

Nota: Bagi Semenanjung Malaysia merujuk kepada hutan paya laut di dalam Hutan Simpanan Kekal (HSK)

Notes: For Peninsular Malaysia refer to mangrove forests in the Permanent Reserved Forest (PRF)

Jadual 1.15: Status kualiti udara mengikut stesen, Pulau Pinang, 2019 dan 2020

Table 1.15: Air quality status by station, Pulau Pinang, 2019 and 2020

Bilangan hari
Number of days

Stesen <i>Station</i>	Tahun <i>Year</i>	Baik <i>Good</i> (0-50)	Sederhana <i>Moderate</i> (51-100)	Tidak Sihat <i>Unhealthy</i> (101-200)	Sangat Tidak Sihat <i>Very Unhealthy</i> (201-300)	Berbahaya <i>Hazardous</i> (>300)
Balik Pulau	2019	57	298	8	2	-
	2020	83	281	2	-	-
Perai	2019	44	317	4	-	-
	2020	77	289	-	-	-
Seberang Jaya	2019	30	330	5	-	-
	2020	36	330	-	-	-
USM	2019	50	305	8	2	-
	2020	114	252	-	-	-

Nota:

Notes:

Stesen yang tidak mencukupi 365 hari adalah disebabkan masalah teknikal

Stations with inadequate 365 days is due to technical problem

Sumber: Jabatan Alam Sekitar

Source: Department of Environment

Jadual 1.16: Bacaan minimum dan maksimum bulanan IPU¹, Pulau Pinang, 2020

Table 1.16: Monthly minimum and maximum API, Pulau Pinang, 2020

Stesen Station	Jan.		Feb.		Mac Mar.		Apr.		Mei May.		Jun June	
	Min.	Maks. Max.	Min.	Maks. Max.	Min.	Maks. Max.	Min.	Maks. Max.	Min.	Maks. Max.	Min.	Maks. Max.
Balik Pulau	41	68	30	68	47	73	18	64	20	101	28	73
Perai	29	67	31	66	46	71	21	57	25	63	39	85
Seberang Jaya	48	67	37	67	47	73	25	61	23	71	35	84
USM	31	66	35	64	42	71	22	58	21	93	26	75

Stesen Station	Julai July		Ogos Aug.		Sept.		Okt. Oct.		Nov.		Dis. Dec.	
	Min.	Maks. Max.	Min.	Maks. Max.	Min.	Maks. Max.	Min.	Maks. Max.	Min.	Maks. Max.	Min.	Maks. Max.
Balik Pulau	25	77	27	125	14	66	17	74	21	69	17	66
Perai	31	74	29	88	19	72	23	73	20	65	21	63
Seberang Jaya	39	74	40	98	22	75	30	78	30	68	29	65
USM	23	69	26	82	14	64	21	69	20	60	19	60

Nota:
Notes:

Sumber: Jabatan Alam Sekitar
Source: Department of Environment

¹ Bacaan status kualiti udara berdasarkan bacaan maksimum harian
Air quality status readings are based on daily maximum readings

Status Indeks Pencemaran Udara (IPU)
Air Pollutant Index (API) status

IPU / API	Status IPU / API 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 1.17: Purata bulanan kepekatan Habuk Halus (PM_{2.5}) di udara, Pulau Pinang, 2019 dan 2020

Table 1.17: Monthly average concentration of Particulate Matter (PM_{2.5}) in the air, Pulau Pinang, 2019 and 2020

Stesen Station	Tahun Year	Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Balik Pulau	2019	13.94	20.00	25.55	17.45	12.67	19.23	28.06	31.61	54.19	14.11	12.04	17.78
	2020	19.62	16.45	22.59	13.99	11.96	15.16	15.75	24.39	12.47	11.74	11.04	13.76
Perai	2019	17.77	19.08	23.37	17.59	13.49	17.82	25.29	26.90	39.08	12.29	12.48	15.47
	2020	18.96	16.25	21.52	12.02	11.75	17.34	15.89	22.15	13.34	12.25	11.82	11.88
Seberang Jaya	2019	19.67	21.40	25.71	19.39	14.68	18.79	26.20	28.85	44.01	13.15	13.66	17.33
	2020	19.19	18.15	24.22	13.50	12.48	17.09	18.46	26.15	16.68	15.26	14.13	14.11
USM	2019	16.06	18.58	23.86	19.31	14.10	17.13	26.09	28.44	49.52	12.90	10.66	14.17
	2020	16.68	15.21	20.78	10.95	10.94	15.42	13.92	19.44	12.60	10.92	10.74	11.28

µg/m³

Nota:

Notes:

Sumber: Jabatan Alam Sekitar

Source: Department of Environment

Garis Panduan Kualiti Udara Malaysia: PM_{2.5} tidak melebihi 50 µg/m³

Malaysian Ambient Air Quality Guidelines: PM_{2.5} not exceeding 50 µg/m³

Jadual 1.18: Purata bulanan kepekatan Habuk Halus (PM₁₀) di udara, Pulau Pinang, 2019 dan 2020

Table 1.18: Monthly average concentration of Particulate Matter (PM₁₀) in the air, Pulau Pinang, 2019 and 2020

Stesen Station	Tahun Year	Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Balik Pulau	2019	21.19	29.01	35.57	25.92	21.37	27.95	38.58	42.33	65.27	20.27	18.18	25.19
	2020	29.04	24.95	30.41	19.52	18.79	22.07	22.80	32.03	19.70	19.45	17.46	20.20
Perai	2019	29.17	28.80	34.27	26.57	21.87	25.75	32.55	31.62	43.02	16.13	20.88	23.41
	2020	28.14	26.76	30.94	18.33	19.26	26.23	24.55	32.05	20.78	19.19	16.62	16.57
Seberang Jaya	2019	30.29	31.21	36.35	28.03	22.20	25.66	31.74	32.10	46.45	14.80	17.88	25.15
	2020	28.38	27.10	32.81	19.19	19.45	25.30	26.14	35.10	24.30	22.76	21.07	21.48
USM	2019	24.09	26.10	31.98	25.65	20.76	23.34	34.36	36.46	58.20	17.80	15.94	20.69
	2020	24.41	23.03	27.94	15.29	16.29	21.29	19.89	25.99	18.39	16.43	15.45	16.55

µg/m³

Nota:

Notes:

Sumber: Jabatan Alam Sekitar

Source: Department of Environment

Garis Panduan Kualiti Udara Malaysia: PM₁₀ tidak melebihi 120 µg/m³

Malaysian Ambient Air Quality Guidelines: PM₁₀ not exceeding 120 µg/m³ within

Jadual 1.19: Purata bulanan kepekatan Ozon Permukaan Bumi (O₃) di udara, Pulau Pinang, 2019 dan 2020

Table 1.19: Monthly average concentration of Ground Level Ozone (O₃) in the air, Pulau Pinang, 2019 and 2020

ppm

Stesen Station	Tahun Year	Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Balik Pulau	2019	0.030	0.029	0.030	0.023	0.019	0.026	0.030	0.027	0.028	0.021	0.021	0.030
	2020	0.028	0.029	0.026	0.023	0.022	0.025	0.025	0.026	0.020	0.016	0.019	0.025
Perai	2019	0.021	0.021	0.023	0.017	0.012	0.019	0.023	0.020	0.020	0.014	0.014	0.022
	2020	0.021	0.021	0.020	0.015	0.013	0.014	0.013	0.013	0.008	0.006	0.006	0.009
Seberang Jaya	2019	0.019	0.020	0.021	0.014	0.011	0.019	0.023	0.021	0.020	0.012	0.013	0.017
	2020	0.019	0.021	0.022	0.019	0.016	0.020	0.019	0.020	0.014	0.010	0.012	0.015
USM	2019	0.029	0.030	0.034	0.026	0.020	0.026	0.030	0.027	0.026	0.019	0.020	0.027
	2020	0.029	0.030	0.031	0.026	0.024	0.027	0.025	0.029	0.020	0.016	0.019	0.025

Nota:

Notes:

Garis Panduan Kualiti Udara Malaysia: O₃ tidak melebihi 0.1 ppm

Malaysian Ambient Air Quality Guidelines: O₃ not exceeding 0.1 ppm

Sumber: Jabatan Alam Sekitar

Source: Department of Environment

Jadual 1.20: Purata bulanan kepekatan Karbon Monoksida (CO) di udara, Pulau Pinang, 2019 dan 2020

Table 1.20: Monthly average concentration of Carbon Monoxide (CO) in the air, Pulau Pinang, 2019 and 2020

ppm

Stesen Station	Tahun Year	Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Balik Pulau	2019	0.515	0.533	0.518	0.476	0.418	0.447	0.517	0.566	0.768	0.495	0.495	0.441
	2020	0.524	0.468	0.527	0.398	0.473	0.560	0.517	0.500	0.505	0.467	0.491	0.552
Perai	2019	0.730	0.692	0.730	0.720	0.704	0.646	0.739	0.840	1.021	0.711	0.738	0.584
	2020	0.644	0.592	0.638	0.473	0.576	0.582	0.732	0.819	0.746	0.808	0.705	0.715
Seberang Jaya	2019	0.960	0.849	0.943	0.920	0.982	0.811	0.975	1.071	1.316	1.012	1.025	0.948
	2020	0.894	0.771	0.722	0.547	0.573	0.620	0.663	0.755	0.764	0.820	0.626	0.556
USM	2019	0.748	0.537	0.613	0.656	0.658	0.574	0.600	0.602	0.833	0.647	0.543	0.535
	2020	0.588	0.573	0.566	0.456	0.525	0.453	0.582	0.527	0.597	0.546	0.564	0.717

Nota:

Garis Panduan Kualiti Udara Malaysia: CO tidak melebihi 9 ppm

Malaysian Ambient Air Quality Guidelines: CO not exceeding 9 ppm

Sumber: Jabatan Alam Sekitar

Source: Department of Environment

Jadual 1.21: Purata bulanan kepekatan Sulfur Dioksida (SO₂) di udara, Pulau Pinang, 2019 dan 2020
Table 1.21: Monthly average concentration of Sulphur Dioxide (SO₂) in the air, Pulau Pinang, 2019 and 2020

Stesen Station	Tahun Year	ppm											
		Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Balik Pulau	2019	0.0010	0.0010	0.0010	0.0012	0.0009	0.0014	0.0009	0.0011	0.0013	0.0010	0.0009	0.0012
	2020	0.0013	0.0006	0.0006	0.0008	0.0010	0.0013	0.0010	0.0011	0.0008	0.0008	0.0009	0.0009
Perai	2019	0.0007	0.0006	0.0010	0.0010	0.0010	0.0010	0.0007	0.0011	0.0011	0.0009	0.0007	0.0007
	2020	0.0007	0.0007	0.0006	0.0005	0.0006	0.0008	0.0008	0.0007	0.0007	0.0005	0.0005	0.0006
Seberang Jaya	2019	0.0011	0.0011	0.0011	0.0011	0.0013	0.0017	0.0010	0.0011	0.0013	0.0009	0.0010	0.0010
	2020	0.0009	0.0009	0.0010	0.0010	0.0011	0.0009	0.0010	0.0009	0.0010	0.0010	0.0008	0.0012
USM	2019	0.0011	0.0010	0.0010	0.0014	0.0012	0.0015	0.0013	0.0013	0.0013	0.0010	0.0012	0.0008
	2020	0.0011	0.0008	0.0010	0.0009	0.0009	0.0012	0.0012	0.0019	0.0011	0.0010	0.0007	0.0008

Nota:

Garis Panduan Kualiti Udara Malaysia: SO₂ tidak melebihi 0.035 ppm
Malaysian Ambient Air Quality Guidelines: SO₂ not exceeding 0.035 ppm

Sumber: Jabatan Alam Sekitar

Source: Department of Environment

Jadual 1.22: Purata bulanan kepekatan Nitrogen Dioksida (NO₂) di udara, Pulau Pinang, 2019 dan 2020
Table 1.22: Monthly average concentration of Nitrogen Dioxide (NO₂) in the air, Pulau Pinang, 2019 and 2020

Stesen Station	Tahun Year	ppm											
		Jan.	Feb.	Mac Mar.	Apr.	Mei May	Jun June	Julai July	Ogos Aug.	Sept.	Okt. Oct.	Nov.	Dis. Dec.
Balik Pulau	2019	0.0038	0.0042	0.0040	0.0037	0.0034	0.0040	0.0042	0.0042	0.0039	0.0035	0.0039	0.0038
	2020	0.0039	0.0040	0.0038	0.0028	0.0028	0.0033	0.0033	0.0041	0.0033	0.0028	0.0032	0.0032
Perai	2019	0.0091	0.0089	0.0094	0.0097	0.0094	0.0103	0.0098	0.0095	0.0107	0.0092	0.0086	0.0076
	2020	0.0086	0.0073	0.0064	0.0047	0.0052	0.0073	0.0083	0.0079	0.0082	0.0086	0.0077	0.0067
Seberang Jaya	2019	0.0173	0.0162	0.0159	0.0155	0.0150	0.0133	0.0138	0.0143	0.0155	0.0150	0.0149	0.0156
	2020	0.0156	0.0145	0.0102	0.0065	0.0094	0.0106	0.0119	0.0117	0.0118	0.0114	0.0113	0.0137
USM	2019	0.0085	0.0093	0.0078	0.0084	0.0084	0.0085	0.0073	0.0084	0.0107	0.0085	0.0090	0.0087
	2020	0.0078	0.0073	0.0064	0.0043	0.0045	0.0055	0.0062	0.0047	0.0068	0.0072	0.0065	0.0067

Nota:

Notes:

Garis Panduan Kualiti Udara Malaysia: NO₂ tidak melebihi 0.16 ppm
Malaysian Ambient Air Quality Guidelines: NO₂ not exceeding 0.16 ppm

Sumber: Jabatan Alam Sekitar

Source: Department of Environment

Jadual 1.23: Status kualiti air marin di Kawasan pesisiran pantai, muara sungai dan pulau berdasarkan Indeks Kualiti Air Marin, Pulau Pinang, 2017-2020

Table 1.23: Status of marine water quality in coastal, estuary and island areas based on Marine Water Quality Index, Pulau Pinang, 2017-2020

Bilangan stesen
Number of stations

Kategori Category	Tahun Year															
	2017				2018				2019				2020			
	E	G	M	P	E	G	M	P	E	G	M	P	E	G	M	P
Pesisiran Pantai Coastal	-	3	13	1	5	2	10	-	-	2	15	-	-	6	11	-
Muara Estuary	-	-	5	2	-	-	5	2	-	-	6	1	-	-	3	4
Pulau Island	-	2	7	-	2	3	4	-	-	1	8	-	2	2	5	-

Nota:

Sumber: Jabatan Alam Sekitar
Source: Department of Environment

Klasifikasi Indeks Kualiti Air Marin:
Marine Water Quality Index Classification:

Kategori Category	Nilai indeks Index value
E	Terbaik/Excellent (90 - 100)
G	Baik/Good (80 - <90)
M	Sederhana/Moderate (50 - <80)
P	Tercemar/Poor (0 - <50)

Jadual 2.1: Keluasan hutan yang dilesenkan untuk pengusahaan, Pulau Pinang, 2014-2018

Table 2.1: Forest area licensed for harvesting, Pulau Pinang, 2014-2018

						Hektar Hectares
Tahun Year	2014	2015	2016	2017	2018	
Keluasan Area	-	-	-	9	-	

Sumber: Jabatan Perhutanan Semenanjung Malaysia
Source: Forest Department Peninsular Malaysia

Jadual 2.2: Pengeluaran produk kayu-kayan utama, Pulau Pinang, 2014-2018

Table 2.2: Production of major timber products, Pulau Pinang, 2014-2018

Tahun Year	Kayu balak ¹ Logs	Kayu gergaji Sawn timber	Papan lapis Plywood	Venir Veneer	Kayu kumai Moulding	Meter padu Cubic metres
2014	-	46,410	26,703	-	13,358	
2015	-	44,874	39,421	-	14,285	
2016	-	43,087	32,067	-	16,249	
2017	-	58,923	41,246	3,159	13,179	
2018	-	49,271	27,615	1,597	8,251	

Nota:
Notes:

Sumber: Jabatan Perhutanan Semenanjung Malaysia
Source: Forest Department Peninsular Malaysia

¹ Tidak termasuk pengeluaran kayu getah, kayu jaras, batang kelapa dan batang kelapa sawit
Exclude production of hevea logs, poles, coconut trunks and oil palm trunks

Jadual 2.3: Pendaratan ikan laut, Pulau Pinang, 2016-2020

Table 2.3: Landings of marine fish, Pulau Pinang, 2016-2020

Negeri State											Tan metrik ('000) Metric Tonnes
	2016		2017		2018		2019		2020		
	Kuantiti Quantity	%	Kuantiti Quantity	%	Kuantiti Quantity	%	Kuantiti Quantity	%	Kuantiti Quantity	%	
Malaysia	1,583.8	100.0	1,465.2	100.0	1,476.9	100.0	1,455.4	100.0	1,383.3	100.0	
Pulau Pinang	56.9	3.6	51.2	3.5	54.9	3.7	51.7	3.6	56.8	4.1	

Sumber: Jabatan Perikanan Malaysia
Source: Department of Fisheries Malaysia

Jadual 2.4: Bilangan ternakan mengikut negeri, Pulau Pinang, 2019

Table 2.4: Number of livestock, Pulau Pinang, 2019

Negeri State	Jenis ternakan Type of livestock						Bilangan Number
	Kerbau Buffalo	Lembu Cattle	Kambing Goat	Bebiri Sheep	Babi Swine	Ayam Chicken	Itik Duck
Jumlah Total	615	10,635	8,145	2,541	325,156	13,281,265	330,200

Sumber: Jabatan Perkhidmatan Veterinar
Source: Department of Veterinary Services

Jadual 2.5: Anggaran bilangan ternakan, Pulau Pinang, 2020

Table 2.5: Estimated number of livestock, Pulau Pinang, 2020

Negeri State	Jenis ternakan Type of livestock						Bilangan Number
	Kerbau Buffalo	Lembu Cattle	Kambing Goat	Bebiri Sheep	Babi Swine	Ayam Chicken	Itik Duck
Jumlah Total	651	10,902	8,777	2,590	327,476	13,859,042	338,433

Sumber: Jabatan Perkhidmatan Veterinar
Source: Department of Veterinary Services

Jadual 2.6: Reka bentuk kapasiti loji rawatan air, Pulau Pinang, 2016-2020

Table 2.6: Water treatment plants design capacity, Pulau Pinang, 2016-2020

Tahun Year	Juta liter sehari (JLH) Million litres per day (MLD)				
	2016	2017	2018	2019	2020 ^P
Kapasiti Capacity	1,599	1,599	1,599	1,599	1,599

Sumber: Suruhanjaya Perkhidmatan Air Negara
Source: National Water Services Commission

Jadual 2.7: Pengeluaran air yang dibekalkan, Pulau Pinang, 2016-2020

Table 2.7: Production of water supplied, Pulau Pinang, 2016-2020

Tahun Year	Juta liter sehari (JLH) Million litres per day (MLD)				
	2016	2017	2018	2019	2020 ^P
Pengeluaran Production	1,054	1,058	1,073	1,093	1,108

Sumber: Suruhanjaya Perkhidmatan Air Negara
Source: National Water Services Commission

Jadual 2.8: Bekalan air mentah diabstrak dari sungai dan empangan, Pulau Pinang, 2016-2020

Table 2.8: Supply of abstracted raw water from rivers and storage dams, Pulau Pinang, 2016-2020

Tahun Year	Juta liter sehari (JLH) Million litres per day (MLD)				
	2016	2017	2018	2019	2020 ^P
Sungai Rivers	1,064	989	1,010	1,037	1,297
Empangan Storage dams	91	101	95	84	87

Sumber: Suruhanjaya Perkhidmatan Air Negara
Source: National Water Services Commission

Jadual 2.9: Penggunaan air bermeter mengikut sektor, Pulau Pinang, 2016-2020

Table 2.9: Metered water consumption by sector, Pulau Pinang, 2016-2020

Juta liter sehari (JLH) Million litres per day (MLD)										
Sektor Sector	Domestik Domestic					Bukan domestik Non-domestic				
Tahun Year	2016	2017	2018	2019	2020 ^P	2016	2017	2018	2019	2020 ^P
Pulau Pinang	492	482	491	499	533	335	344	349	343	314

Sumber: Suruhanjaya Perkhidmatan Air Negara
Source: National Water Services Commission

Jadual 3.1: Loji rawatan pembetungan awam, Pulau Pinang, 2018-2020

Table 3.1: Public sewerage treatment plant, Pulau Pinang, 2018-2020

Population equivalent (PE)

Negeri State	LRP multipoint Multipoint STP ¹			Loji serantau Regional plant ²			Jumlah Total		
	2018	2019	2020 ^P	2018	2019	2020 ^P	2018	2019	2020 ^P
Population equivalent (PE)	1,138,505	1,176,672	1,193,737	1,637,015	1,687,451	1,750,553	2,775,520	2,864,123	2,944,290

Nota:
Notes:

¹LRP multipoint: LRP untuk memenuhi pembangunan yang sporadis dan bertaburan oleh pemaju yang berbeza
Multipoint STP: STPs to cater for sporadic and scattered development by different developers

²Loji serantau: LRP yang dikenal pasti dalam Kajian Pengawasan Pembetungan untuk menampung kawasan tadahan pembetungan
Regional plant: STPs identified in the Sewerage Catchment Study to cater for a sewerage catchment area

Sumber: Suruhanjaya Perkhidmatan Air Negara
Source: National Water Services Commission

Jadual 3.2: Buangan terjadual, Pulau Pinang, 2016-2020

Table 3.2: Scheduled waste, Pulau Pinang, 2016-2020

Tan metrik
Metric Tonnes

Tahun Year	2016	2017	2018	2019	2020
Kuantiti Quantity	220,559	195,358	98,884	326,884	405,501

Nota: Mulai 2015, statistik ini termasuk buangan terjadual yang diuruskan di bawah pengurusan khas mengikut Peraturan 7, Peraturan-Peraturan Kualiti Alam Sekeliling (Buangan Terjadual) 2005 (Pengurusan Khas)
Note: Since 2015, these statistics include scheduled wastes are managed under special management under Rule 7 of the Rules, the Environmental Quality (Scheduled Wastes) 2005 (Special Management)

Sumber: Jabatan Alam Sekitar
Source: Department of Environment

Jadual 3.3: Kuantiti buangan klinikal, Pulau Pinang, 2016-2020

Table 3.3: Quantity of clinical waste by state, Pulau Pinang, 2016-2020

Tan metrik
Metric Tonnes

Tahun Year	2016	2017	2018	2019	2020
Kuantiti Quantity	1,949.0	2,052.3	2,344.7	2,360.3	3,336.0

Sumber: Jabatan Alam Sekitar
Source: Department of Environment

Jadual 3.4: Bilangan tapak pelupusan sisa pepejal yang beroperasi, Pulau Pinang, 2016-2020

Table 3.4: Number of operating solid waste landfills, Pulau Pinang, 2016-2020

Tahun Year	Sanitari Sanitary	Bukan sanitari Non-sanitary	Lengai Inert
2016	1	1	-
2017	1	-	1
2018	1	-	1
2019	1	-	1
2020	1	-	1

Sumber: Kementerian Perumahan dan Kerajaan Tempatan
Source: Ministry of Housing and Local Government

Jadual 4.1: Bilangan kejadian banjir yang dilaporkan, Pulau Pinang, 2016-2020

Table 4.1: Number of flood incidents reported, Pulau Pinang, 2016-2020

Tahun Year	2016	2017	2018	2019	2020
Bilangan Number	46	33	29	31	28

Sumber: Jabatan Pengairan dan Saliran
Source: Department of Irrigation and Drainage

Jadual 4.2: Bilangan kemalangan jalan raya dan kecederaan yang dilaporkan, Pulau Pinang, 2016-2020

Table 4.2: Number of road accidents and casualties reported, Pulau Pinang, 2016-2020

Tahun Year	Kemalangan jalan raya Road accidents	Kecederaan Casualties		
		Kecederaan ¹ Injury	Kematian Death	Jumlah Total
2016	42,244	598	411	1,009
2017	43,007	312	401	713
2018	45,734	221	390	611
2019	47,198	152	392	544
2020	35,234	244	287	531

¹Kecederaan merujuk kepada kecederaan ringan dan parah
Injury refer to minor and serious injuries

Sumber: Polis Diraja Malaysia
Source: Royal Malaysia Police

Jadual 4.3: Bilangan kejadian kebakaran, Pulau Pinang, 2016-2020

Table 4.3: Number of fire incidents, Pulau Pinang, 2016-2020

Tahun Year	2016	2017	2018	2019	2020
Bilangan Number	3,495	2,138	2,203	2,860	2,758

Sumber: Kementerian Perumahan dan Kerajaan Tempatan
Source: Ministry of Housing and Local Government

Jadual 4.4: Bilangan kematian, kecederaan dan anggaran kerugian akibat kebakaran yang dilaporkan, Pulau Pinang, 2016-2020

Table 4.4: Number of deaths, injuries and estimated losses caused by fire reported, Pulau Pinang, 2016-2020

Tahun Year	Kematian Death	Kecederaan Injury	Kerugian Loss (RM juta/ millions)
2016	4	31	223.4
2017	7	29	912.8
2018	3	31	495.5
2019	2	29	66.2
2020	14	44	101.1

Sumber: Kementerian Perumahan dan Kerajaan Tempatan
Source: Ministry of Housing and Local Government

Jadual 4.5: Taburan kawasan hakisan pantai di Pulau Pinang, 2020

Table 4.5: Distribution of coastal erosion areas in Pulau Pinang, 2020

Negeri State	Jumlah (km) Total	Pantai yang mengalami hakisan mengikut kategori ^e Coastal erode by category						Panjang (km) Length	
		Kategori 1 Category		Kategori 2 Category		Kategori 3 Category		Jumlah hakisan (km) Total erosion	%
		Bil. kawasan No. of area	Panjang agregat (km) Aggregate length	Bil. kawasan No. of area	Panjang agregat (km) Aggregate length	Bil. kawasan No. of area	Panjang agregat (km) Aggregate length		
Malaysia	8,840.0	44	55.4	309	375.9	2,344	916.3	1,347.6	15.2
Pulau Pinang	215.6	7	4.7	13	5.0	31	6.6	16.3	7.6

Sumber: Jabatan Pengairan dan Saliran
Source: Department of Irrigation and Drainage

Nota:
Notes:

Kategori 1: Pengunduran garis pantai yang cepat dengan kadar melebihi 4 meter/tahun umumnya di kawasan dengan penduduk yang agak padat bersama aktiviti komersial/ industri yang mendapat perkhidmatan infrastruktur dan kemudahan awam.

Category 1: Fast retreating coastline at the rate of more than 4m/year with generally fairly dense human settlement, with some commercial/ industrial activities being served by significant public infrastructure and facilities.

Kategori 2: Pengunduran garis pantai dengan kadar lebih dari 1 meter/tahun tetapi kurang dari 4 meter/tahun umumnya di kawasan berpenduduk tidak padat dengan sedikit aktiviti pertanian yang mendapat perkhidmatan infrastruktur dan kemudahan awam yang kurang sempurna.

Category 2: Retreating coastline at the rate of between more than 1m/year but less than 4m/ year with generally sparsely-populated area, with some agricultural activities being served by relatively minor public infrastructure and facilities.

Kategori 3: Pengunduran garis pantai dengan kadar kurang dari 1 meter/tahun umumnya di kawasan tanpa penduduk dengan aktiviti pertanian yang minimum yang tidak mendapat perkhidmatan infrastruktur dan kemudahan awam.

Category 3: Slowly retreating coastline of less than 1m/year with generally no human settlement and minimal agricultural activities, and not served by public infrastructure and facilities.

Berdasarkan *National Coastal Erosion Study for Malaysia (2015)*
Based on *National Coastal Erosion Study for Malaysia (2015)*

Jadual 5.1: Anggaran penduduk pertengahan tahun, Pulau Pinang, 2017-2021

Table 5.1: Mid-year population estimates, Pulau Pinang, 2017-2021

Tahun Year	2017	2018	2019	2020	2021 ^e	Kadar pertumbuhan penduduk tahunan Annual population growth rate (%)
	('000)					
						2018/2019 2019/2020
Penduduk Population	1,744.1	1,762.8	1,768.8	1,770.4	1,774.4	0.1 0.2

Nota: Berdasarkan Anggaran Penduduk Pertengahan Tahun berasaskan data Banci Penduduk dan Perumahan 2010 yang disesuaikan

Note: Mid-Year Population Estimates based on adjusted Population and Housing Census of Malaysia 2010

^e Anggaran/ Estimates

Hasil tambah mungkin berbeza kerana pembundaran

The added total may differ due to rounding

Jadual 5.2: Kepadatan penduduk, Pulau Pinang, 2017-2021

Table 5.2: Population density, Pulau Pinang, 2017-2021

Tahun Year	2017	2018	2019	2020	2021 ^e	Bilangan orang bagi setiap km ² Number of persons per km ²
Kepadatan penduduk Population density	1,663	1,681	1,686	1,688	1,691	

Nota: Berdasarkan Anggaran Penduduk Pertengahan Tahun berasaskan data Banci Penduduk dan Perumahan 2010 yang disesuaikan

Note: Mid-Year population Estimates based on adjusted Population and Housing Census of Malaysia 2010

^e Anggaran/ Estimates

Hasil tambah mungkin berbeza kerana pembundaran

The added total may differ due to rounding

Jadual 5.3: Penduduk dengan air paip yang dirawat mengikut strata, Pulau Pinang, 2016-2019

Table 5.3: Population with treated piped water by strata, Pulau Pinang, 2016-2019

Tahun Year	2016			2017			2018			2019 ^p		
Strata Strata	Bandar Urban	Luar bandar Rural	Purata negeri State average	Bandar Urban	Luar bandar Rural	Purata negeri State average	Bandar Urban	Luar bandar Rural	Purata negeri State average	Bandar Urban	Luar bandar Rural	Purata negeri State average
Peratus Per cent	100.0	99.7	99.9	100.0	99.8	99.9	100.0	99.8	99.9	100.0	99.8	99.9

Sumber: Suruhanjaya Perkhidmatan Air Negara
Source: National Water Services Commission

Jadual 5.4: Kadar tarif air bagi domestik, Pulau Pinang, 2020

Table 5.4: Water tariff rates for domestic, Pulau Pinang, 2020

	Semakan tariff terakhir Last tariff Review	Purata tarif air Average water tariff		
		20m ³ pertama first 20m ³	30m ³ pertama first 30m ³	35m ³ pertama first 35m ³
Purata negara National average		0.52	0.65	0.69
Pulau Pinang	2015	0.22	0.30	0.32

RM/m³

Sumber: Kementerian Alam Sekitar dan Air
Suruhanjaya Perkhidmatan Air Negara
Source: Ministry of Environment and Water
National Water Services Commission

Jadual 5.5: Kadar tarif air bagi industri, Pulau Pinang, 2020

Table 5.5: Water tariff rates for industry, Pulau Pinang, 2020

	Semakan tariff terakhir Last tariff Review	Purata tarif air Average water tariff		
		20m ³ pertama first 20m ³	30m ³ pertama first 30m ³	35m ³ pertama first 35m ³
Purata negara National average		1.64	1.67	1.74
Pulau Pinang	2015	1.13	1.18	1.36

RM/m³

Sumber: Kementerian Alam Sekitar dan Air
Suruhanjaya Perkhidmatan Air Negara
Source: Ministry of Environment and Water and
National Water Services Commission

Jadual 5.6: Peratus isi rumah dengan kemudahan bekalan elektrik mengikut strata, Pulau Pinang, 2019

Table 5.6: Percentage of households with the accessibility to electricity supply by strata, Pulau Pinang, 2019

	Kemudahan bekalan elektrik Accessible to electricity		
	Jumlah Total	Bandar Urban	Luar bandar Rural
Malaysia	100.0	100.0	100.0
Pulau Pinang	100.0	100.0	100.0

Nota: Berdasarkan Laporan Penyiasatan Pendapatan Isi Rumah dan Kemudahan Asas 2019

Note: Based on Household Income and Basic Amenities Report 2019

Jadual 5.7: Bilangan ketibaan dan pelepasan kapal laut yang terlibat dalam perdagangan luar negeri, Pulau Pinang, 2016-2020

Table 5.7: Number of arrivals and departures of ocean-going vessel engaged in foreign trade, Pulau Pinang, 2016-2020

Pelabuhan Port	Ketibaan Arrivals					Berlepas Departures				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Pulau Pinang	3,844	3,882	3,721	5,770	-	3,948	3,875	3,776	5,798	-

Sumber: Suruhanjaya Pelabuhan Pulau Pinang, Penang Port Sdn. Bhd.,
Source: Penang Port Commission, Penang Port Sdn Bhd.,

Jadual 5.8: Kargo yang dikendalikan mengikut pelabuhan, Pulau Pinang, 2016-2020

Table 5.8: Cargo throughput by port, Pulau Pinang, 2016-2020

Pelabuhan Port		Tan metrik (freightweight) '000 Metric Tonnes				
		2016	2017	2018	2019	2020
	Jumlah Total	30,298	32,131	33,739	32,575	29,236
Pulau Pinang	Import Imports	16,482	17,416	18,658	17,654	15,876
	Eksport Exports	13,816	14,715	15,081	14,921	13,360

Nota: Tidak termasuk pindah kapal
Note: Excluding trans-shipment

Sumber: Kementerian Pengangkutan
Source: Ministry of Transport

Jadual 5.9: Kadar insiden keracunan makanan dan tifoid, Pulau Pinang, 2016-2020

Table 5.9: Incidence rate of food poisoning and typhoid, Pulau Pinang, 2016-2020

Insiden Incidence	Bagi setiap 100,000 penduduk Per 100,000 population				
	2016	2017	2018	2019	2020
Keracunan makanan Food poisoning	35.4	49.9	65.5	35.7	18.4
Tifoid Typhoid	0.2	0.3	0.3	0.7	0.2

Sumber: Kementerian Kesihatan Malaysia
Source: Ministry of Health Malaysia

Jadual 5.10: Bilangan kes demam denggi, demam denggi berdarah dan malaria, Pulau Pinang, 2016-2020

Table 5.10: Number of dengue fever, dengue haemorrhagic fever and malaria cases, Pulau Pinang, 2016-2020

Kes Cases	2016	2017	2018	2019	2020
Demam denggi <i>Dengue fever</i>	2,562	2,664	6,052	4,107	1,039
Demam denggi berdarah <i>Dengue haemorrhagic fever</i>	14	17	19	12	4
Malaria <i>Malaria</i>	3	9	6	6	2

Sumber: Kementerian Kesihatan Malaysia
Source: Ministry of Health Malaysia

Jadual 6.1: Perbelanjaan perlindungan alam sekitar mengikut jenis perbelanjaan, Pulau Pinang, 2019

Table 6.1: Environmental protection expenditure by type of expenditure, Pulau Pinang, 2019

RM '000

Jenis Type	Jumlah Total	Pengurusan pencemaran Pollution management	Perlindungan hidupan liar & habitat Protection of wildlife & habitats	Penilaian dan caj alam sekitar Environmental assessment and charges	Pengurusan sisa Waste management	Perbelanjaan lain untuk perlindungan alam sekitar Other environmental protection expenditure
Jumlah Total	177,632	115,353	-	3,781	57,054	1,443
Modal Capital	30,367	29,620	-	94	608	44
Operasi Operation	147,266	85,733	-	3,687	56,446	1,399

Nota: Berdasarkan kepada Laporan Penyiasatan Perbelanjaan Perlindungan Alam Sekitar, Malaysia, 2020

Note: Based on Report on the Survey of Environmental Protection Expenditure, Malaysia, 2020

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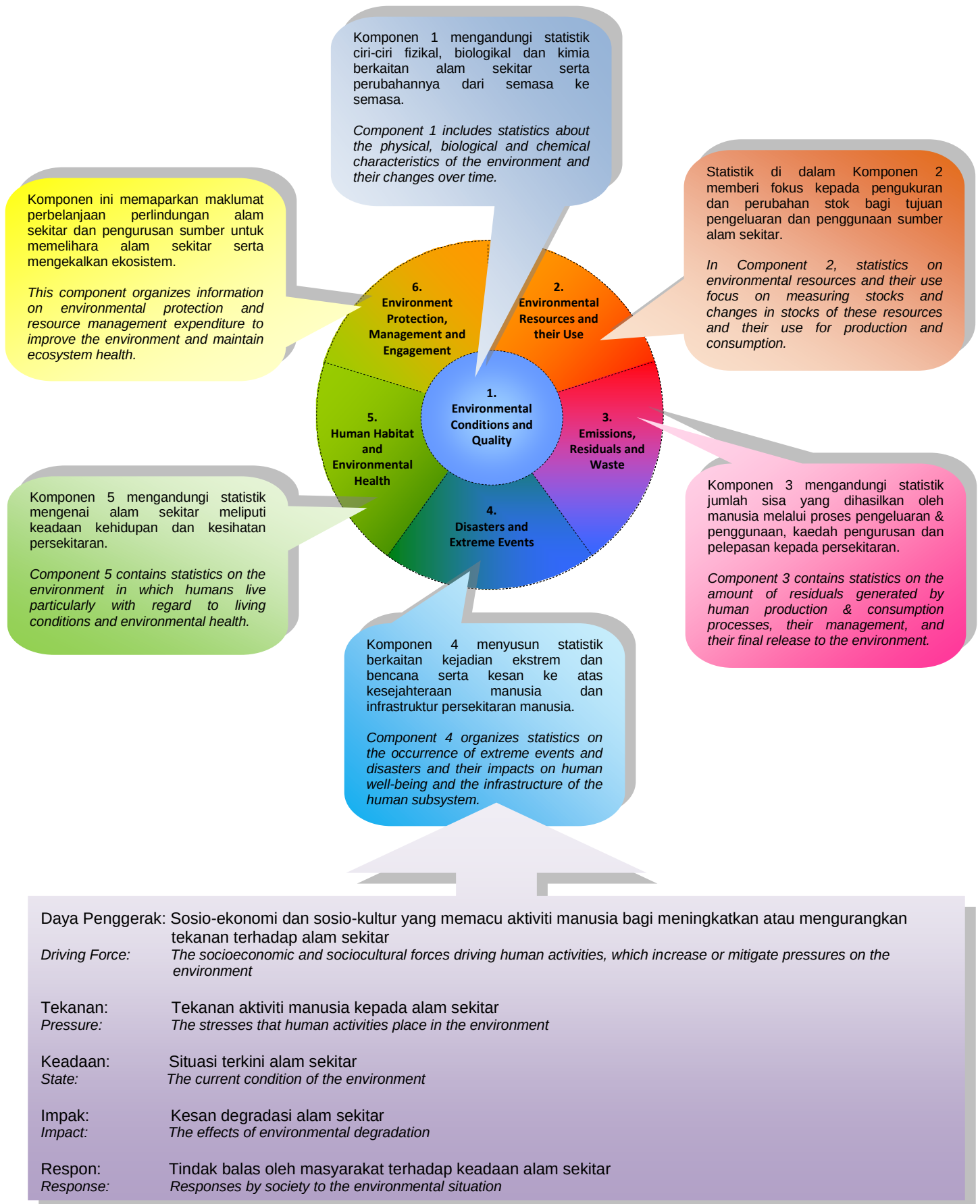
APPENDICES



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**Framework for the Development of Environment Statistics (FDES) dan hubungan kait dengan rangka kerja
Daya Penggerak-Tekanan-Keadaan-Impak-Respon (DPSIR)**

The FDES and its relationship with the Driving Force-Pressure-State-Impact-Response (DPSIR) framework



Sumber: Framework for the Development of Environment Statistics (FDES 2013)
Source:

Perbandingan nilai IPU dengan tahap pencemaran dan kawalan kesihatan
Comparison of API values with level of pollution and health measures

Indeks Pencemaran Udara (IPU) <i>Air Pollutant Index (API)</i>	Status	Tahap pencemaran <i>Level of pollution</i>	Kawalan kesihatan <i>Health measures</i>
0 – 50	Baik	Pencemaran rendah yang tidak ada kesan buruk terhadap kesihatan	Tidak ada sekatan aktiviti bagi semua lapisan orang. Amalkan gaya hidup yang sihat seperti tidak merokok, kerap bersenam dan mengamalkan pemakanan yang sesuai
	Good	<i>Low pollution and has no ill-effects on health</i>	<i>No restriction of activities for all groups of people. To practice healthy lifestyle e.g. not to smoke, exercise regularly and to observe proper nutrition</i>
51 – 100	Sederhana	Pencemaran sederhana dan tidak ada kesan buruk terhadap kesihatan	Tidak ada sekatan aktiviti bagi semua lapisan orang. Amalkan gaya hidup yang sihat seperti tidak merokok, kerap bersenam dan mengamalkan pemakanan yang sesuai
	Moderate	<i>Moderate pollution and has no ill-effects on health</i>	<i>No restriction of activities for all groups of people. To practice healthy lifestyle e.g. not to smoke, exercise regularly and to observe proper nutrition</i>
101 – 200	Tidak Sihat	Tanda-tanda sederhana yang menyebabkan bertambah teruk di kalangan orang berisiko tinggi, iaitu mereka yang menghidap sakit jantung dan paru-paru	Sekatan aktiviti kegiatan luar terhadap bagi orang yang berisiko tinggi. Penduduk amnya perlu mengurangkan aktiviti yang lasak
	Unhealthy	<i>Mild aggravation of symptoms among high risk persons, i.e. those with heart or lung disease</i>	<i>Restriction of outdoor activities for high risk persons. The population should reduce vigorous outdoor activity</i>
201 – 300	Sangat Tidak Sihat	Tanda-tanda ketara yang menyebabkan bertambah teruk dan toleransi senaman rendah di kalangan orang yang mengidap sakit jantung atau paru-paru	Warga tua dan orang yang menghidap penyakit jantung atau paru-paru dilarang keluar dan kurangkan aktiviti fizikal. Penduduk amnya mesti mengelakkan dari aktiviti luar yang lasak. Sesiapa yang menghadapi masalah kesihatan perlu merujuk kepada doktor
	Very Unhealthy	<i>Significant aggravation of symptoms and decreased exercise tolerance in person with heart or lung disease</i>	<i>Elderly and persons with known heart or lung disease should stay indoors and reduce physical activity. Population should avoid vigorous outdoor activity. Those with any health problems to consult a doctor</i>
301 – 500	Berbahaya	Tanda-tanda yang menyebabkan bertambah teruk dan membahayakan kesihatan	Warga tua dan orang yang menghidap penyakit jantung atau paru-paru dilarang keluar dan kurangkan aktiviti lasak. Penduduk amnya mesti menghindari aktiviti luar yang lasak
	Hazardous	<i>Severe aggravation of symptoms and endangers health</i>	<i>Elderly and persons with existing heart or lung disease should stay indoors and reduce physical activity. General population should avoid vigorous outdoor activity</i>
Melebihi 500	Kecemasan	Tanda-tanda yang menyebabkan bertambah teruk dan membahayakan kesihatan	Penduduk amnya dinasihatkan mengikut peraturan oleh Majlis Keselamatan Negara dan sentiasa mengikut pengumuman melalui media massa
Above 500	Emergency	<i>Severe aggravation of symptoms and endangers health</i>	<i>General population are advised to follow the orders of the National Security Council and follow the announcements through the mass media</i>

Sumber: Kementerian Kesihatan Malaysia
 Source: Ministry of Health Malaysia

Punca dan kesan bahan pencemar udara kepada manusia dan tumbuhan*Sources and effects of air pollutants on human and plants*

Bahan pencemar udara <i>Air pollutant</i>	Punca <i>Source</i>	Kesan kepada kesihatan manusia dan ekologi <i>Human health and ecological effects</i>
Ozon (O ₃) <i>Ozone</i>	Motosikal dua lejang, kenderaan bermotor dan punca-punca industri. <i>Two-stroke motor cycles, motor vehicles and industrial sources.</i>	Manusia/Human Menjejaskan fungsi pernafasan dan penurunan prestasi atlet yang melakukan senaman lasak dan bahaya penyakit barah kulit <i>Impairment of respiratory function and decreasing performance by some athletes exercising heavily and skin cancer risks</i> Tumbuhan/Plants Memusnahkan tumbuhan dan mengurangkan pengeluaran tanaman <i>Damage vegetation and reduces crop production</i>
Plumbum (Pb) <i>Lead</i>	Sektor pengangkutan <i>Transport sector</i>	Manusia/Human Pendedahan yang berlarutan boleh mengakibatkan gangguan sistem saraf <i>Long-term exposure can lead to nervous disorders</i>
Karbon Monoksida (CO) <i>Carbon Monoxide</i>	Sektor pengangkutan <i>Transport sector</i>	Manusia/Human Menjejaskan mereka yang merokok dan yang menhidap masalah peredaran darah dan anemia <i>Affects smokers and people with circulatory and anaemic problems</i>
Sulfur Dioksida (SO ₂) <i>Sulphur Dioxide</i>	Industri minyak dan gas, pengeluaran tenaga, pembakaran arang, proses industri dan industri berasaskan pembakaran <i>Oil and gas industry, energy production, coal burning, industrial combustion and industrial process</i>	Manusia/Human Menambahkan derita pesakit yang menhidap asma dan bronkitis <i>Aggravates asthmatic and bronchitis patients</i> Tumbuhan/Plants Memusnahkan tumbuhan <i>Damages vegetation</i>
Nitrogen Dioksida (NO ₂) <i>Nitrogen Dioxide</i>	Pengangkutan, penjana kuasa dan industri berasaskan pembakaran <i>Transport, power generation and industrial combustion</i>	Manusia/Human Menjejaskan fungsi pernafasan <i>Affects respiratory function</i> Tumbuhan/Plants Menyekat pertumbuhan tanaman <i>Suppresses vegetation growth</i>
Habuk Halus (PM ₁₀) <i>Particulate Matter</i>	Pembakaran terbuka <i>Open burning</i>	Manusia/Human Melemahkan fungsi pernafasan <i>Impairs respiratory function</i> Tumbuhan/Plants Memusnahkan tumbuhan <i>Damages vegetation</i>

Sumber: Kementerian Kesihatan Malaysia
Source: Ministry of Health Malaysia

Klasifikasi kualiti air berdasarkan Indeks Kualiti Air
Water quality classification based on Water Quality Index

Parameter	Indeks Index		
	Bersih (B) <i>Clean (C)</i>	Sederhana Tercemar (ST) <i>Slightly Polluted (SP)</i>	Tercemar (T) <i>Polluted (P)</i>
Indeks Kualiti Air (IKA) <i>Water Quality Index (WQI)</i>	81 – 100	60 – 80	0 – 59
Keperluan Oksigen Biokimia (BOD ₅) <i>Biochemical Oxygen Demand</i>	91 – 100	80 – 90	0 – 79
Ammoniakal Nitrogen (NH ₃ -N) <i>Ammoniacal Nitrogen</i>	92 – 100	71 – 91	0 – 70
Pepejal Terampai (SS) <i>Suspended Solids</i>	76 – 100	70 – 75	0 – 69

Sumber: Jabatan Alam Sekitar
 Source: Department of Environment

Klasifikasi Indeks Kualiti Air
Water Quality Index classification

Parameter	Unit	Kelas Class				
		I	II	III	IV	V
Ammoniakal Nitrogen (NH ₃ -N) <i>Ammoniacal Nitrogen</i>	mg/l	< 0.1	0.1 - 0.3	0.3 - 0.9	0.9 - 2.7	> 2.7
Keperluan Oksigen Biokimia (BOD ₅) <i>Biochemical Oxygen Demand</i>	mg/l	< 1	1 - 3	3 - 6	6 - 12	> 12
Keperluan Oksigen Kimia (COD) <i>Chemical Oxygen Demand</i>	mg/l	< 10	10 - 25	25 - 50	50 - 100	> 100
Oksigen Terlarut <i>Dissolved Oxygen</i>	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
Jumlah Pepejal Terampai (SS) <i>Total Suspended Solid</i>	mg/l	< 25	25 - 50	50 - 150	150 - 300	> 300
Indeks Kualiti Air (IKA) <i>Water Quality Index (WQI)</i>		> 92.7	76.5 - 92.7	51.9 - 76.5	31.0 - 51.9	< 31.0

Kelas air dan kegunaan
Water classes and uses

Kelas Class	Kegunaan Uses
Kelas I Class I	Pemuliharaan alam semula jadi <i>Conservation of natural environment</i> Bekalan Air I – Hampir tiada rawatan diperlukan <i>Water Supply I – Practically no treatment necessary</i> Perikanan I – Spesis akuatik yang sangat sensitif <i>Fishery I – Very sensitive aquatic species</i>
Kelas IIA Class IIA	Bekalan Air II – Memerlukan rawatan secara konvensional sahaja <i>Water Supply II – Conventional treatment required</i> Perikanan II – Spesis akuatik yang sensitif <i>Fishery II – Sensitive aquatic species</i>
Kelas IIB Class IIB	Kegunaan rekreasi yang melibatkan persentuhan badan dengan air <i>Recreational use with body contact</i>
Kelas III Class III	Bekalan Air III – Memerlukan rawatan yang ekstensif <i>Water Supply III – Extensive treatment required</i> Perikanan III – Spesis tertentu yang mempunyai nilai ekonomi biasa Bekalan air minum haiwan ternakan <i>Fishery III – Tolerant species with common economic value</i> <i>Livestock drinking</i>
Kelas IV Class IV	Pengairan <i>Irrigation</i>
Kelas V Class V	Tiada seperti di atas. <i>None of the above</i>

Sumber: Jabatan Alam Sekitar
Source: Department of Environment

Standard dan kriteria kualiti air marin*Marine water quality criteria and standards*

	Parameter	KELAS 1 CLASS 1	KELAS 2 CLASS 2	KELAS 3 CLASS 3	KELAS E CLASS E
	Kegunaan	Pemeliharaan, kawasan dilindungi, Taman Laut	Kehidupan laut, Perikanan, Terumbu Karang, Rekreasi dan Marikultur	Pelabuhan, Lapangan Minyak & Gas	Paya Bakau & Muara Sungai
	Uses	<i>Preservation, marine protected areas, Marine Parks</i>	<i>Marine Life, Fisheries, Coral Reefs, Recreational and Mariculture</i>	<i>Ports, Oil & Gas Fields</i>	<i>Mangroves, Estuarine & River-mouth Water</i>
1	Suhu (°C) Temperature	$\leq 2^{\circ}\text{C}$ peningkatan terhadap ambien maksimum $\leq 2^{\circ}\text{C}$ increase over maximum ambient			
2	Oksigen Terlarut (mg/L) Dissolved Oxygen	>80% tepu >80% saturation	5	3	4
3	Jumlah Pepejal Terampai* (mg/L) Total Suspended Solid	25 mg/L atau $\leq 10\%$ peningkatan dalam purata bermusim, yang mana lebih rendah 25 mg/L or $\leq 10\%$ increase in seasonal average, whichever is lower	50 mg/L (25 mg/L) atau $\leq 10\%$ peningkatan dalam purata bermusim, yang mana lebih rendah 50mg/L (25 mg/L) or $\leq 10\%$ increase in seasonal average, whichever is lower	100 mg/L atau $\leq 10\%$ peningkatan dalam purata bermusim, yang mana lebih rendah 100 mg/L or $\leq 10\%$ increase in seasonal average, whichever is lower	100 mg/L atau $\leq 30\%$ peningkatan dalam purata bermusim, yang mana lebih rendah 100 mg/L or $\leq 30\%$ increase in seasonal average, whichever is lower
4	Minyak dan Geris (mg/L) Oil and Grease	0.01	0.14	5	0.14
5	Raksa*(µg/L) Mercury	0.04	0.16 (0.04)	50	0.5
6	Kadmium*(µg/L) Cadmium	0.5	2 (3)	10	2
7	Kromium (VI) (µg/L) Chromium	5	10	48	10
8	Kuprum (µg/L) Copper	1.3	2.9	10	2.9
9	Arsenik (III)* (µg/L) Arsenic	3	20(3)	50	20(3)
10	Plumbum(µg/L) Lead	4.4	8.5	50	8.5
11	Zink (µg/L) Zinc	15	50	100	50
12	Sianida(µg/L) Cyanide	2	7	20	7
13	Ammonia (tidak terion) (µg/L) Ammonia (unionized)	35	70	320	70
14	Nitrit(NO ₂) (µg/L) Nitrite (NO ₂)	10	55	1,000	55
15	Nitrat(NO ₃) (µg/L) Nitrate (NO ₃)	10	60	1,000	60
16	Fosfat(µg/L) Phosphate	5	75	670	75
17	Fenol (µg/L) Phenol	1	10	100	10
18	Tributyltin (TBT) (µg/L)	0.001	0.01	0.05	0.01
19	Faecal Coliform	70 faecal coliform 100mL ⁻¹	70 faecal coliform 100mL ⁻¹ & (70 faecal coliform 100mL ⁻¹)	200 faecal coliform 100mL ⁻¹	100 faecal coliform 100mL ⁻¹ & (70 faecal coliform 100mL ⁻¹)
20	Polycyclic Aromatic Hydrocarbon (PAHs) µg/L	100	200	1,000	1,000

Sumber: Jabatan Alam Sekitar

Source: Department of Environment

*Nilai Standard dan Kriteria Kualiti Air Marin (SKKAM) dalam kurungan digunakan untuk kawasan air marin yang menjadi sumber makanan laut
Marine Water Quality Criteria and Standard (MWQCS) in parentheses are for coastal and marine water areas where seafood for human consumption is applicable

Status kualiti air bagi lembangan sungai Bersih yang diawasi, Pulau Pinang, 2019 dan 2020*Water quality status for monitored Clean river basins, Pulau Pinang, 2019 and 2020*

Negeri State	Lembangan Sungai River Basin	Sungai River	Bilangan Stesen Number of Stations	2019			2020		
				IKA WQI	Kategori Category	Kelas Class	IKA WQI	Kategori Category	Kelas Class
Pulau Pinang	Sg. Pinang	Sg. Air Terjun	1	93	B/C	I	95	B/C	I
		Sg. Batu Feringghi	2	87	B/C	II	92	B/C	II
		Sg. Satu	1	93	B/C	I	96	B/C	I
	Sg. Juru	Sg. Ara	1	66	ST/SP	III	82	B/C	II
Pulau Pinang/ Kedah	Sg. Perai	Sg. Kulim	5	91	B/C	II	89	B/C	II
Pulau Pinang/ Kedah/ Perak	Sg. Kerian	Sg. Kechil	2	85	B/C	II	86	B/C	II
		Sg. Selama	3	87	B/C	II	88	B/C	II
		Sg. Kerian	6	83	B/C	II	86	B/C	II
		Sg. Terusan Bagan Serai	1	91	B/C	II	93	B/C	I
		Sg. Semang	1	74	ST/SP	III	81	B/C	II

Nota:*Notes:***B/C:** Bersih/ Clean**ST/SP:** Sederhana tercemar/ Slightly polluted**T/P:** Tercemar/ Polluted**Sumber:** Jabatan Alam Sekitar*Source:* Department of Environment

Status kualiti air bagi lembangan sungai Sederhana Tercemar yang diawasi, Pulau Pinang, 2019 dan 2020*Water quality status for monitored Slightly Polluted river basins, Pulau Pinang, 2019 and 2020*

Negeri State	Lembangan Sungai River Basin	Sungai River	Bilangan Stesen Number of Stations	2019			2020		
				IKA WQI	Kategori Category	Kelas Class	IKA WQI	Kategori Category	Kelas Class
Pulau Pinang	Sg. Bayan Lepas	Sg. Bayan Lepas	1	76	ST/SP	II	64	ST/SP	III
		Sg. Tiram	2	71	ST/SP	III	73	ST/SP	III
	Sg. Jawi	Sg. Junjong	3	62	ST/SP	III	66	ST/SP	III
		Sg. Machang Bubok	1	70	ST/SP	III	76	ST/SP	III
	Sg. Juru	Sg. Juru	2	56	T/P	III	68	ST/SP	III
		Sg. Kilang Ubi	5	68	ST/SP	III	70	ST/SP	III
		Sg. Pasir	1	61	ST/SP	III	65	ST/SP	III
	Sg. Kluang	Sg. Ara	2	85	B/C	II	67	ST/SP	III
		Sg. Dua Besar	1	57	T/P	III	64	ST/SP	III
		Sg. Kluang	1	63	ST/SP	III	65	ST/SP	III
		Sg. Relau	1	66	ST/SP	III	66	ST/SP	III
	Sg. Pinang	Sg. Air Itam	3	76	ST/SP	II	77	ST/SP	II
		Sg. Dondang	6	74	ST/SP	III	73	ST/SP	III
		Sg. Jelutong	1	64	ST/SP	III	63	ST/SP	III
		Sg. Pinang	3	68	ST/SP	III	69	ST/SP	III
		Sg. Titi Kerawang	1	63	ST/SP	III	68	ST/SP	III
Pulau Pinang/ Kedah	Sg. Perai	Sg. Kubang Semang	1	64	ST/SP	III	64	ST/SP	III
		Sg. Seluang	1	64	ST/SP	III	64	ST/SP	III
		Sg. Keladi	1	74	ST/SP	III	78	ST/SP	II
		Sg. Perai	2	63	ST/SP	III	66	ST/SP	III
		Sg. Seluang Bawah	2	65	ST/SP	III	61	ST/SP	III
		Sg. Jarak	6	72	ST/SP	III	73	ST/SP	III
		Sg. Pertama	1	59	T/P	III	65	ST/SP	III
Pulau Pinang/ Kedah/ Perak	Sg. Kerian	Sg. Serdang	1	73	ST/SP	III	71	ST/SP	III

Nota:
Notes:

B/C: Bersih/ Clean
ST/SP: Sederhana tercemar/ Slightly polluted
T/P: Tercemar/ Polluted

Sumber: Jabatan Alam Sekitar
Source: Department of Environment

Status kualiti air bagi lembangan sungai Tercemar yang diawasi, Pulau Pinang, 2019 dan 2020*Water quality status for monitored Polluted river basins, Pulau Pinang, 2019 and 2020*

Negeri State	Lembangan Sungai River Basin	Sungai River	Bilangan Stesen Number of Stations	2019			2020		
				IKA WQI	Kategori Category	Kelas Class	IKA WQI	Kategori Category	Kelas Class
Pulau Pinang	Sg. Jawi	Sg. Jawi	1	49	T/P	IV	55	T/P	III
		Sg. Tengah	1	61	ST/ TP	III	49	T/P	IV
		Sg. Chempedak	1	54	T/P	III	47	T/P	IV
	Sg. Juru	Sg. Permatang Rawa	2	64	ST/ TP	III	59	T/P	III
		Sg. Rambai	2	51	T/P	IV	57	T/P	III
Pulau Pinang/ Kedah	Sg. Perai	Sg. Air Melintas	1	54	T/P	III	58	T/P	III
		Sg. Kereh	3	57	T/P	III	55	T/P	III

Nota:*Notes:***B/C: Bersih/** *Clean***ST/SP: Sederhana tercemar/** *Slightly polluted***T/P: Tercemar/** *Polluted***Sumber: Jabatan Alam Sekitar***Source: Department of Environment*

Status kualiti air marin di kawasan pantai, Pulau Pinang, 2018-2020*Marine water quality status for coastal, Pulau Pinang, 2018-2020*

Negeri State	Kawasan Area	Nilai IKAM MWQI Value			Kategori Category (2020)
		2018	2019	2020	
Pulau Pinang	Gertak Sanggul	81	58	84	Baik/Good
	Kawasan Perindustrian Bayan Lepas I	59	56	56	Sederhana/ Moderate
	Kawasan Perindustrian Bayan Lepas II**	-	-	-	Stesen tutup/ Station closed
	Kawasan Perindustrian Bayan Lepas III**	-	-	-	Stesen tutup/ Station closed
	Pantai Bersih	66	58	58	Sederhana/ Moderate
	Pantai Miami	93	69	81	Baik/Good
	Pantai Pasir Panjang	93	81	81	Baik/Good
	Batu Ferringgi (Casuarina)	67	60	58	Sederhana/ Moderate
	Luar Pantai Teluk Bahang	93	57	83	Baik/Good
	Persiaran Gurney	66	58	59	Sederhana/ Moderate
	Rumah Pam Baru Perai	64	56	61	Sederhana/ Moderate
	Rumah Pam Lama Perai	65	57	60	Sederhana/ Moderate
	Selat PP Selatan (Jelutong)	59	57	55	Sederhana/ Moderate
	Tanjung Bungah	67	57	70	Sederhana/ Moderate
	Teluk Tempoyak	75	57	69	Sederhana/ Moderate
	Batu Maung	62	57	56	Sederhana/ Moderate
	Pantai Sungai Batu Ferringhi 3*	93	83	84	Baik/Good
	Pantai Sungai Batu Ferringhi 2*	93	70	74	Sederhana/ Moderate
	Pantai Sungai Batu Ferringhi 1*	85	71	85	Baik/Good

Nota/Note:* **Stesen baru**
New station** **Stesen tutup**
Station closed- **Tiada data**
No data**Sumber: Jabatan Alam Sekitar**

Source: Department of Environment

Status kualiti air marin di kawasan muara sungai, Pulau Pinang, 2018-2020*Marine water quality status for estuary, Pulau Pinang, 2018-2020*

Negeri State	Kawasan Area	Nilai IKAM MWQI Value			Kategori Category (2020)
		2018	2019	2020	
Pulau Pinang	Kuala Sungai Jawi	54	46	38	Tercemar/Poor
	Kuala Sungai Juru	47	51	30	Tercemar/Poor
	Kuala Sungai Kerian	60	52	54	Sederhana/ Moderate
	Kuala Sungai Pinang	61	52	53	Sederhana/ Moderate
	Kuala Sungai Perai	59	53	43	Tercemar/Poor
	Kuala Sungai Tengah	37	52	52	Sederhana/ Moderate
	Kuala Sungai Pinang (Balik Pulau)	64	50	48	Tercemar/Poor

Sumber: Jabatan Alam Sekitar
Source: Department of Environment

Nota/Note:

- **Tiada data**
No data

Status kualiti air marin di kawasan pulau, Pulau Pinang, 2018-2020*Marine water quality status for island, Pulau Pinang, 2018-2020*

Negeri State	Kawasan Area	Nilai IKAM MWQI Value			Kategori Category (2020)
		2018	2019	2020	
Pulau Pinang	Tanjung Tokong*	66	57	57	Sederhana/ Moderate
	Batu Maung	62	55	67	Sederhana/ Moderate
	Padang Kota	65	58	85	Baik/Good
	Teluk Bahang*	82	59	71	Sederhana/ Moderate
	Aman	88	60	72	Sederhana/ Moderate
	Jerejak	65	57	58	Sederhana/ Moderate
	Kendi	93	77	93	Terbaik/ Excellent
	Rimau	93	85	90	Terbaik/ Excellent
	Gedong	86	56	84	Baik/Good

Sumber: Jabatan Alam Sekitar
Source: Department of Environment

Nota/Note:

* **Stesen baru**
New station

NOTA DAN SIMBOL
NOTES AND SYMBOLS

-	tiada/kosong/tiada kes <i>nil/blank/no cases</i>
..	tidak diperoleh <i>not available</i>
n.a.	tidak berkenaan <i>not applicable</i>
Def.	nilai defektif <i>defective value</i>
0.0	kurang daripada setengah unit terkecil yang ditunjukkan <i>less than half the smallest unit shown</i>
r	pindaan <i>revised</i>
e	anggaran <i>estimate</i>
p	awalan <i>preliminary</i>
i.e.	iaitu <i>that is</i>
PM	Habuk Halus <i>Particulate Matter</i>
CO	Karbon Monoksida <i>Carbon Monoxide</i>
NO ₂	Nitrogen Dioksida <i>Nitrogen Dioxide</i>
O ₃	Ozon <i>Ground Level Ozone</i>
SO ₂	Sulfur Dioksida <i>Sulphur Dioxide</i>
m/s	meter per saat <i>metre per second</i>
hPa	hektopascal <i>hectopascals</i>
MJ/m ²	megajoule per meter persegi <i>megajoule per square metre</i>
µg/m ³	mikrogram setiap meter padu <i>microgram per cubic metre</i>
ppm	bahagian setiap juta <i>parts per million</i>
ppb	bahagian setiap bilion <i>parts per billion</i>
km ²	kilometer persegi <i>square kilometres</i>
mg/l	miligram setiap liter <i>milligram per litres</i>

JKPS <i>MMscf</i>	juta kaki padu standard <i>million standard cubic feet</i>
bil. <i>no.</i>	bilangan <i>number</i>
max.	maksimum <i>maximum</i>
min.	minimum
RM	Ringgit Malaysia
FDES	Rangka Kerja untuk Pembangunan Perangkaan Alam Sekitar <i>Framework for the Development of Environment Statistics</i>
KETSA	Kementerian Tanah dan Sumber Asli <i>Ministry of Land and Natural Resources</i>
ILP	Institut Latihan Perindustrian <i>Industrial Training Institute</i>
IPD	Ibu Pejabat Polis Daerah
LPG	Gas Asli cecair <i>Liquefied Petroleum Gas</i>
MPOB	Lembaga Minyak Sawit Malaysia <i>Malaysian Palm Oil Board</i>
PERHILITAN <i>DWNP</i>	Jabatan Perlindungan Hidupan Liar dan Taman Negara <i>Department of Wildlife and National Parks</i>
UPE <i>EPU</i>	Unit Perancang Ekonomi <i>Economic Planning Unit</i>
UNEP	Program Alam Sekitar Bangsa-Bangsa Bersatu <i>United Nations Environment Programme</i>
W.P.	Wilayah Persekutuan

NOTA
NOTE

Pembundaran: Jumlah bagi komponen mungkin berbeza dengan jumlah besar dalam jadual penerbitan disebabkan oleh pembundaran angka
Rounding: The sum of components may not add up to the totals in the tables presented in this publication due to rounding

GLOSARI

GLOSSARY



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TERMA	PENERANGAN	TERMS	EXPLANATIONS
A			
Air payau	Air yang mengandungi garam yang mana kepekatan garamnya kurang daripada kepekatan garam dalam air laut. Kepekatan jumlah garam yang terlarut biasanya dalam lingkungan 1,000-10,000 miligram per liter (mg/l).	Brackish water	<i>Water containing salts at a concentration significantly lower than that of sea water. The concentration of total dissolved salts is usually in the range of 1,000-10,000 milligrams per litre (mg/l).</i>
Air tawar	Air bersih semula jadi yang mengandungi kurang kepekatan garam. Pada amnya ia sesuai untuk pengeluaran dan dirawat supaya menjadi air bersih yang sesuai untuk minum.	Freshwater	<i>Naturally occurring water having a low concentration of salts. It is generally accepted as suitable for abstraction and treatment to produce potable water.</i>
Aktiviti perlindungan alam sekitar	Tujuan utama adalah pencegahan, pengurangan dan penghapusan pencemaran dan lain-lain bentuk degradasi alam sekitar.	Environmental protection activities	<i>Primary purpose is the prevention, reduction and elimination of pollution and other forms of degradation of the environment.</i>
Ammoniakal Nitrogen (NH₃-N)	Komponen nitrogen yang digunakan sebagai penunjuk untuk menentukan pencemaran oleh kumbahan. Ia terhasil daripada aktiviti mikrobiologi dan biasanya wujud di dalam air permukaan dan air bawah tanah. Sumber utama bagi bahan pencemar NH ₃ -N adalah kumbahan domestik dan ladang ternakan.	Ammoniacal Nitrogen	<i>A component of nitrogen which is adopted as an indicator to determine pollution by sewage. It is formed from microbiology activity and usually exists inside surface water and groundwater. The main sources of NH₃-N were domestic sewage and livestock farming.</i>
Akuakultur	Akuakultur ialah proses pengeluaran yang melibatkan pengkulturan (termasuk tuaian) organisma akuatik (ikan, moluska, krustasia, tumbuhan) dengan menggunakan teknik yang direka bentuk untuk meningkatkan pengeluaran organisma tersebut melebihi kapasiti persekitaran semula jadinya.	Aquaculture	<i>Aquaculture refer to the production process involving the culturing or farming (including harvesting) of aquatic organisms (fish, molluscs, crustaceans, plant) using techniques designed to increase the production of the organism beyond the natural capacity of the environment.</i>
Atmosfera	Jisim udara yang mengelilingi bumi yang sebahagian besarnya terdiri daripada oksigen dan nitrogen.	Atmosphere	<i>Mass of air surrounding the earth, composed largely of oxygen and nitrogen.</i>
B			
Bahan pencemar udara	Bahan yang terkandung di dalam udara pada kepekatan yang cukup tinggi, boleh memudaratkan kesihatan manusia, haiwan, tanaman dan harta benda. Pencemar udara adalah termasuk bahan yang hampir kepada bentuk asal atau kandungan tiruan yang wujud terapung di udara. Ia boleh terdiri daripada pepejal, titisan cecair atau gas atau gabungan kesemuanya.	Air pollutants	<i>Substances in air that could, at high enough concentrations, harm human beings, animals, vegetation or material. Air pollutants may thus include forms of matter of almost any natural or artificial composition capable of being airborne. They may consist of solid particles, liquid droplets or gases or combination of these forms.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Bahan pencemar	Bahan yang terdapat dalam kepekatan yang boleh membahayakan organisma (manusia, tumbuhan dan haiwan) atau melebihi standard kualiti alam sekitar. Istilah ini sering digunakan seiring dengan pencemar.	Pollutant	<i>Substance that is present in concentration that may harm organisms (humans, plants and animals) or exceed an environmental quality standard. The term is frequently used synonymously with contaminant.</i>
Banjir	Kuantiti air yang melimpah keluar dari tebing sungai, tasik atau sistem perparitan sedia ada yang disebabkan oleh curahan hujan yang lebat, air laut pasang dan halangan pada sistem saliran.	Flood	<i>A body of water, rising, swelling and overflowing land not usually thus covered. It is also, overflowing of the bank of a stream, lake or drainage system of water onto adjacent land due to storm tidal action and channel obstruction.</i>
Bencana	Bencana merupakan peristiwa luar jangka dan berlaku secara tiba-tiba yang boleh menyebabkan kerosakan, kemusnahan dan penderitaan manusia. Bencana sering digambarkan sebagai kesan daripada pendedahan kepada peristiwa melampau dan boleh dikelaskan sebagai semula jadi dan teknologi bergantung kepada punca.	Disasters	<i>Disasters are unforeseen and often sudden events that cause great damage, destruction and human suffering. A disaster is often described as a result of exposure to the extreme event and can be both natural and technological depending on their cause.</i>
Bencana teknologi	Mungkin disebabkan oleh niat, kecuaiian atau kesilapan manusia, atau daripada aplikasi teknologi yang rosak atau gagal. Tiga jenis bencana teknologi: kemalangan industri, kemalangan pengangkutan dan pelbagai kemalangan.	Technological disasters	<i>May arise as a result of human intent, negligence or error, or from faulty or failed technological applications. Three types of technological disasters: industrial accidents, transport accidents and miscellaneous accidents.</i>
Buangan terjadual	Merupakan buangan toksik dan berbahaya yang dihasilkan oleh industri, pertanian, bengkel, kontraktor buangan terjadual, aktiviti domestik dan buangan klinikal dari hospital. Kategori sisa adalah yang tersenarai dalam Jadual Pertama Peraturan Kualiti Alam Sekeliling (Buangan Terjadual) 2005.	Scheduled waste	<i>Defined as toxic waste and hazardous generated by industries, agriculture, workshop, scheduled waste contractors, domestic activities and clinical wastes from hospitals. The waste category listed in the First Schedule Environmental Quality Regulation (Scheduled Waste) 2005.</i>
D			
Rangka Kerja Driving Force-Pressure-State-Impact-Response (DPSIR)	Rangka analitikal yang berdasarkan hubungan di antara komponen D-P-S-I-R.	Driving Force-Pressure-State-Impact-Response (DPSIR) framework	<i>An analytical framework that is based on the casual relationship between its D-P-S-I-R components.</i>
Demam denggi	Penyakit jangkitan virus yang merebak melalui gigitan nyamuk Aedes aegypti yang telah dijangkiti.	Dengue fever	<i>A type of viral infection that spreads through infected Aedes aegypti mosquito bites.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Disentri	Disentri adalah cirit-birit akut yang mengandungi darah di dalam najis. Disentri kebanyakannya disebabkan oleh spesies <i>Shigella</i> (<i>disentri bacillary</i>) atau <i>Entamoeba histolytica</i> (<i>disentri amoebic</i>).	Dysentery	<i>Dysentery is acute diarrhoea with visible blood in the stool. Dysentery is most often caused by Shigella species (bacillary dysentery) or Entamoeba histolytica (amoebic dysentery).</i>
F			
Fauna	Semua kehidupan haiwan.	Fauna	<i>All animal life.</i>
Flora	Semua kehidupan tumbuhan.	Flora	<i>All plant life.</i>
H			
Habuk Halus (PM)	Partikel pepejal atau titisan cecair dalam udara atau pelepasan yang saiznya 0.01-100µm, contohnya habuk, asap, wasap, semburan dan kabut.	Particulate Matter (PM)	<i>Solid particles or liquid droplets in the air or emission 0.01-100µm size, eg: dust, smoke, fume, spray and mist.</i>
Habuk Halus (PM₁₀)	Partikel terampai berukuran kurang daripada diameter 10 mikron. PM ₁₀ boleh berbentuk pepejal atau cecair dan ia termasuk aerosol, debu, asap dan debunga. Partikel ini berpunca daripada stesen janakuasa, proses industri dan aktiviti pembakaran terbuka.	Particulate Matter (PM₁₀)	<i>Respirable particles of less than 10 micron in diameter. PM₁₀ can be in solid or liquid form and it includes aerosol, dust, smoke and pollen. These particles originate from power plants, industrial processes and open burning activities.</i>
Halaju angin	Suatu kuantiti vektor di mana ia mempunyai magnitud dan arah. Magnitud halaju angin dipanggil laju angin manakala arah angin merujuk dari mana angin bertiup.	Wind velocity	<i>A quantity of vectors in which it has magnitude and direction. The magnitude of the wind velocity is called the wind speed while the wind direction refers to where the wind blows.</i>
Hakisan	Proses penghausan permukaan fizikal. Biasanya dikaitkan dengan kehilangan tanah disebabkan air, salji atau angin. Hakisan berlaku secara semula jadi dan menyebabkan bertambah buruk akibat pembersihan tanah yang berkaitan dengan aktiviti manusia seperti pertanian, perumahan atau perindustrian.	Erosion	<i>Wearing away and transport of the soil by wind or running water, glaciers or waves. Erosion occurs naturally but is often intensified by human land-clearing activities related to farming, residential or industrial development.</i>
Hutan	Tanah merangkumi lebih daripada 0.5 hektar dengan ketinggian pokok lebih daripada 5 meter dan penutup kanopi lebih daripada 10 peratus, atau pokok yang dapat mencapai ambang in situ. Ia tidak termasuk tanah yang didominasi oleh penggunaan tanah pertanian atau bandar.	Forest	<i>Land spanning more than 0.5 hectares with tree higher than 5 metres and a canopy cover of more than 10 per cent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Hutan bandar	Menanam, memelihara dan mengurus pokok di kawasan awam seperti taman rekreasi, taman permainan dan kawasan lapang termasuk sepanjang lebuh raya.	Urban forest	<i>Planting, protecting and managing trees in public areas such as recreational parks, playgrounds and open spaces includes the route along the highway.</i>
Hutan Simpanan Kekal (HSK)	Mana-mana tanah (tanah berhutan dan tidak berhutan) yang diwartakan atau disifatkan sebagai HSK untuk tujuan perhutanan di bawah Seksyen 7, 8 dan 9 Akta Perhutanan Negara.	Permanent Reserved Forest (PRF)	<i>Any land (forested and non-forested land) that has been enacted or deemed PRF for forestry purposes under Sections 7, 8 and 9, the National Forestry Act.</i>
I			
Indeks Kualiti Air	Purata pemberat bagi kepekatan ambien bahan pencemar terpilih biasanya berkait kepada pengelasan kualiti air.	Water Quality Index	<i>Weighted average of selected ambient concentrations of pollutants usually linked to water quality classes.</i>
Indeks Pencemaran Udara (IPU)	Satu indikator yang dicipta berdasarkan kepada penilaian saintifik bagi memaklumkan dengan cara yang mudah difahami kehadiran pencemaran udara dan impaknya terhadap kesihatan manusia. Nilai IPU dikira berdasarkan kepekatan purata setiap pencemar udara iaitu SO ₂ , NO ₂ , CO, O ₃ dan PM ₁₀ . Pencemar udara yang dominan dengan kepekatan tertinggi diambil kira sebagai pencemar yang akan menentukan nilai IPU. Pada lazimnya, kepekatan (PM ₁₀) adalah yang tertinggi berbanding dengan pencemar yang lain dan ini menentukan bacaan IPU.	Air Pollutant Index (API)	<i>An indicator which is created based on scientific assessment to provide user friendly information about the presence of air pollution and its impact on human health. API value is calculated based on the average concentration of each air pollutant SO₂, NO₂, CO, O₃ and PM₁₀. Dominant of air pollutant with the highest concentrations of pollutants are accounted for as that will determine the value of the API. In general, concentrations of PM₁₀ are the highest compared to other concentrations and this determines the API readings.</i>
Indeks UV Suria (UVI)	Menerangkan tentang sinaran UV di permukaan Bumi. Nilai indeks tersebut mempunyai julat dari sifar ke atas – semakin tinggi nilai indeks, semakin besar potensi berlaku kerosakan pada kulit dan mata dan semakin cepat kesan tersebut boleh berlaku.	Solar UV Index (UVI)	<i>Describes the UV rays on the Earth's surface. The value of the index has a range from zero upwards - the higher the value of the index, the greater the potential for damage to the skin and eyes and the faster the effect can occur.</i>
Insinerator	Relau untuk membakar bahan buangan di bawah keadaan terkawal.	Incinerator	<i>Furnace for burning wastes under controlled conditions.</i>
K			
Kadar mortaliti bayi	Nisbah bilangan kematian bayi di bawah umur 1 tahun dalam sesuatu tahun kepada jumlah bilangan kelahiran hidup dalam tahun itu (bagi setiap seribu kelahiran hidup).	Infant mortality rate	<i>The ratio number of deaths of infants under 1 year of age in a given year to the total number of live births in that year (per thousand live births).</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Kawasan tadahan	Kawasan di mana hujan mengalir ke dalam sungai, tasik, atau takungan.	Catchment area	<i>The area from which rainfall flows into a river, lake, or reservoir.</i>
Kapasiti pengeluaran	Keupayaan pengeluaran air bagi loji yang beroperasi sepenuhnya dalam tahun berkenaan. Kapasiti pengeluaran berbeza setiap tahun tertakluk kepada reka bentuk loji.	Production capacity	<i>The ability to produce water by fully operated plants in the respective year. The production capacity varies every year according to the design of the plants.</i>
Karbon Monoksida	Tidak berwarna, tidak berbau dan gas beracun yang dihasilkan oleh pembakaran bahan api dan fosil yang tidak lengkap.	Carbon Monoxide	<i>Colourless, odourless and poisonous gas produced by incomplete fossil fuel combustion.</i>
Kawasan bandar	Kawasan yang diwartakan serta kawasan tepubina yang bersempadan dengannya dan gabungan kedua-dua kawasan ini mempunyai penduduk seramai 10,000 atau lebih. Kawasan tepubina didefinisikan sebagai kawasan yang terletak bersebelahan kawasan yang diwartakan dan mempunyai sekurang-kurangnya 60 peratus (berumur 15 tahun dan lebih) yang terlibat dalam aktiviti bukan Pertanian.	Urban area	<i>Gazetted areas with their adjoining built-up areas which had a combined population of 10,000 or more. Built-up areas were defined as areas contiguous to a gazetted area and had at least 60 per cent of their population (aged 15 years and over) engaged in non-agricultural activities.</i>
Kawasan perlindungan/ simpanan	Kawasan tanah dan/atau laut khususnya bagi perlindungan dan pemuliharaan kepelbagaian biologi, yang berkaitan dengan sumber semula jadi dan diurus melalui perundangan ataupun cara lain yang berkesan. Definisi ini diadaptasi daripada <i>The International Union for Conservation of Nature</i> (IUCN).	Protected/preserved area	<i>An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources and managed through legal or other effective means. This definition is adopted by The International Union for Conservation of Nature (IUCN).</i>
Kemalangan jalan raya	Kemalangan atau kejadian yang mana kerosakan berlaku ke atas mana-mana orang, harta, kenderaan, struktur atau haiwan dan berlaku di mana-mana jalan awam termasuklah jambatan, terowong, hentian sebelah, jalan bertingkat, jejambat, plaza tol dan sebagainya.	Road traffic crash	<i>Accidents or occurrences whereby damage or injury is caused to any person, property, vehicle, structure or animal and occurs in any public road including bridge, tunnels, lay-bye, interchanges, overpasses, toll plazas and so on.</i>
Kelajuan angin permukaan	Merujuk kepada laju angin pada ketinggian piawai 10m di atas tanah.	Surface wind speed	<i>Refers to the wind speed at a standard altitude of 10m above ground.</i>
Kepadatan penduduk	Jumlah bilangan penduduk setiap unit per segi di kawasan muka bumi.	Population density	<i>Total number of inhabitants per square unit of surface area.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Kepelbagaian biologi	Kepelbagaian biologi bermaksud variasi di antara organisma hidup daripada pelbagai sumber termasuk daratan, marin serta ekosistem akuatik lain; ia termasuklah kepelbagaian di dalam peringkat genetik, spesies dan ekosistem. Definisi ini diadaptasi daripada <i>United Nations Convention on Biological Diversity</i> .	<i>Biological diversity</i>	<i>Biological diversity means the variability among living organisms from various sources including terrestrial, marine and other aquatic ecosystems; this includes diversity at the genetic, species and ecosystem level. This definition is adopted by the United Nations Convention on Biological Diversity.</i>
Keperluan Oksigen Biokimia (BOD₅)	Ukuran jumlah oksigen terlarut yang diperlukan oleh organisma untuk mengurai bahan organik yang terdapat di dalam air. Biasanya bacaan diambil dalam tempoh 5 hari.	<i>Biochemical Oxygen Demand (BOD₅)</i>	<i>Dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in water. This measurement is usually taken within 5 days.</i>
Keperluan Oksigen Kimia (COD)	Indeks pencemaran air yang digunakan sebagai ukuran kepekatan jisim oksigen yang diperlukan untuk mengurai bahan organik dan bukan organik.	<i>Chemical Oxygen Demand (COD)</i>	<i>Index of water pollution measuring the mass concentration of oxygen consumed by the chemical breakdown of organic and inorganic matter.</i>
Kolera	Penyakit usus pada umumnya disebabkan oleh pencemaran najis daripada air dan makanan.	<i>Cholera</i>	<i>Intestinal disease generally caused by faecal contamination of water and food.</i>
Kuasa hidro	Tenaga primer yang disimpulkan tersedia untuk pengeluaran elektrik dan ditunjukkan dari segi konvensional setara dengan bahan api fosil menggunakan kecekapan purata penukaran haba untuk tahun tersebut.	<i>Hydropower</i>	<i>Is the inferred primary energy available for electricity production and is shown in terms of conventional fossil fuel equivalent using the average thermal efficiency of conversion for the year.</i>
Kutipan biji benih	Biji benih pokok hutan yang dikutip secara terus dari atas pokok.	<i>Seeds collections</i>	<i>Seeds of forest trees collected directly from the tree.</i>
L			
Ladang hutan	Kawasan yang ditanam dengan pokok atau tumbuh-tumbuhan hutan, sama ada daripada spesies tempatan atau dagang, dengan kaedah tanaman secara terbuka yang luasnya tidak kurang daripada 50 ha. Ladang hutan boleh merangkumi kawasan yang terletak di dalam atau di luar HSK.	<i>Forest plantation</i>	<i>Area planted with trees or forest plants, whether from local or foreign species, the method of cultivation as wide open no less than 50 ha. Forest plantations can include areas that are located within or outside the PRF.</i>
Latar belakang	Stesen yang tidak terpengaruh dengan faktor-faktor pencemaran udara dari industri dan kenderaan bermotor. Stesen ini biasanya ditempatkan di kawasan yang jauh dari punca pencemar dan dijadikan bacaan rujukan bagi kategori stesen yang lain.	<i>Background</i>	<i>Stations that is not affected by air pollution factors from industry and motor vehicles. The station is usually located in a remote area of interest and is a reference point for other categories of stations.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Logam berat	Logam bertoksik yang digunakan dalam proses industri, sebagai contoh, arsenik, kadmium, kromium, tembaga, plumbum, raksa, nikel dan zink. Ia boleh merosakkan kehidupan tumbuhan dan haiwan pada kepekatan yang rendah dan cenderung untuk berkumpul dalam rantai makanan.	Heavy metals	<i>Potentially toxic metals used in industrial processes, for example, arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc. They may damage plant and animal life at low concentrations and tend to accumulate in the food chain.</i>

M

Megakepelbagaian	Konsep megakepelbagaian melibatkan anggaran jumlah bilangan semua organisma hidup di dalam ekosistem dan ini bermakna sesuatu kawasan itu mempunyai sekurang-kurangnya 60.0 peratus daripada spesis yang diketahui di dunia. Sebahagian besar daripada kepelbagaian tersebut adalah endemisme dan ini menggambarkan keunikan kawasan tersebut.	Megadiversity	<i>The concept of megadiversity involves an estimate of the total number of all the organisms in an ecosystem and is represented by an area that comprises at least 60.0 per cent of the world's known species. A major part of diversity is endemism as this reflects the uniqueness of an area.</i>
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N

Nilai defektif	Nilai yang diragui atau nilai yang tidak diterima setelah menjalani proses semakan kualiti data.	Defective value	<i>A doubtful value or an unacceptable value after undergoing a data quality review process.</i>
Nilai pH	Ukuran kepada keasidan untuk nilai alkali dalam cecair. Nilai pH di antara lingkungan 0 ke 7 menunjukkan asid, nilai pH di antara lingkungan 7 ke 14 menunjukkan alkali, dan nilai pH 7 menandakan neutral.	pH Value	<i>Measure of the acidity or alkalinity of a liquid. A pH value in the range of 0 to 7 indicates acidity, a pH value in the range of 7 to 14 indicates alkalinity, and a pH value of 7 signifies neutrality.</i>
Nitrogen Dioksida (NO₂)	Nitrogen Dioksida terbentuk di persekitaran udara melalui pengoksidaan Nitrogen Monoksida (NO). Gas bertoksik berwarna merah keperangan ini mempunyai bau yang kuat dan tajam.	Nitrogen Dioxide (NO₂)	<i>Nitrogen Dioxide is formed in the ambient air through the oxidation of Nitrogen Monoxide (NO). This reddish brown toxic gas has a sharp and pungent odour.</i>

O

Oksigen Terlarut (DO)	Jumlah gas oksigen (O ₂) yang berada dalam air, dikira mengikut kandungannya dalam isi padu air (miligram O ₂ seliter) atau jumlah peratusnya dalam air tepu.	Dissolved Oxygen (DO)	<i>Amount of gaseous oxygen (O₂) actually present in water expressed in terms either of its presence in the volume of water (milligrams of O₂ per litre) or of its share in saturated water (percentage).</i>
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TERMA	PENERANGAN	TERMS	EXPLANATIONS
Ozon (O₃)	Gas yang mengeluarkan bau yang tidak menyenangkan, tidak berwarna dan bertoksik yang menyumbang kepada fotokimia asbut (campuran asap dan kabut). O ₃ terbentuk hasil daripada reaksi kimia antara Sebatian Organik Meruap (VOC) dan Nitrogen Oksida (NO _x). Pada lewat tengah hari atau awal petang, lazimnya kepekatan ozon adalah tinggi dan mendominasi bacaan IPU di sesetengah kawasan. Di bawah pengaruh cahaya matahari, NO _x dan VOC yang dilepaskan dari ekzos kenderaan bermotor dan industri ia bertindak balas bagi membentuk ozon di permukaan bumi.	Ground Level Ozone (O₃)	<i>A pungent, colourless and toxic gas that contributes to photochemical smog. O₃ is formed as a result of chemical reaction in the air between Volatile Organic Compounds (VOCs) and Nitrogen Oxide (NO_x). By the late afternoon or early evening, usually O₃ concentration is high and dominating API readings in some areas. Under the sunlight influence, and reaction between NO_x and VOC that released from motor vehicles exhaust and industrial which form the O₃ in the earth's surface. Under the influence of sunlight, nitrogen oxide (NO_x) and volatile organic compounds (VOCs) emitted from motor vehicle exhaust and industry reacts to form O₃ in the earth's surface.</i>

P

Pelepasan	Pembuangan bahan pencemar ke atmosfera dari punca tetap seperti cerobong asap dan lain-lain, kawasan komersial atau perindustrian dan juga berpunca daripada punca bergerak seperti kenderaan bermotor, lokomotif dan pesawat.	Emission	<i>Discharge of pollutants into the atmosphere from stationary sources such as smokestacks, other vents, surface areas of commercial or industrial facilities and mobile sources, for example, motor vehicles, locomotives and aircraft.</i>
Pemantauan kualiti udara	Bacaan <i>standard</i> dan pemerhatian terhadap udara yang diambil secara berterusan atau kerap yang digunakan sebagai peringatan dan kawalan.	Air quality monitoring	<i>Continuous or frequent standardised measurement and observation of the air, often used for warning and control.</i>
Pencemaran marin	Pengenalan langsung atau tidak langsung oleh manusia atau tenaga ke dalam alam sekitar marin (termasuk muara), menghasilkan kemusnahan kepada sumber kehidupan, berbahaya kepada kesihatan hidupan, halangan kepada kegiatan marin termasuk memancing, merosakkan kualiti air laut dan mengurangkan keselesaan.	Marine pollution	<i>Direct or indirect introduction by humans of substances or energy into the marine environment (including estuaries), resulting in harm to living resources, hazards to human health, hindrances to marine activities including fishing, impairment of the quality of sea water and reduction of amenities.</i>
Pencemaran udara	Kandungan sesuatu gas, cecair atau zarah yang terampai di udara ambien yang boleh menjejaskan kehidupan atau memberi kesan negatif kepada manusia, tumbuh-tumbuhan dan haiwan.	Air pollution	<i>Content of a gas, liquid or particles suspended in the ambient air that could affect life or a negative impact on humans, plants and animals.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Penempatan penduduk	Konsep penyatuan yang terdiri daripada (a) komponen fizikal tempat berteduh dan infrastruktur dan (b) perkhidmatan yang mana menyokong penyediaan elemen fizikal. Ini boleh dikatakan seperti perkhidmatan komuniti seperti pendidikan, kesihatan, kebudayaan, kebajikan, rekreasi dan pemakanan.	Human settlements	<i>Integrative concept that comprises (a) physical components of shelter and infrastructure and (b) services to which the physical elements provide support, that is to say, community services such as education, health, culture, welfare, recreation and nutrition.</i>
Pengawasan kualiti air	Bacaan <i>standard</i> dan pemerhatian terhadap air yang diambil secara berterusan atau kerap yang digunakan sebagai peringatan dan kawalan.	Water quality monitoring	<i>Continuous or frequent standardised measurement and observation of the water often used for warning and control.</i>
Penyejatan	Suatu proses yang melibatkan perubahan fasa cecair kepada gas apabila cecair terdedah kepada atmosfera. Dalam meteorologi ia diukur sebagai jumlah sejatan iaitu jumlah air yang disejat daripada tangki sejatan.	Evaporation	<i>A process that involves the phase change of a liquid to a gas when the liquid is exposed to the atmosphere. In meteorology, it is measured as the amount of evaporation i.e. the amount of water evaporated from the evaporation tank.</i>
Penyiasatan migrasi	Mengumpul maklumat responden di tempat kediaman pada dua titik masa (tarikh tertentu), di mana tempoh antaranya genap satu tahun. Pertukaran lokaliti tempat kediaman pada dua titik masa ini dianggap sebagai migrasi. Penduduk yang bertukar lokaliti tempat kediaman serta selalu merentasi sempadan negeri adalah migran antara negeri.	Migration survey	<i>Collects information on respondents' usual place of residence at two specific points of time which are exactly one year apart. Changes in the usual place of residence locality at these two points in time constitute migration. Population that changes its usual place of residence across state boundaries is known as inter-state migrant.</i>
Pepejal Terampai (SS)	Pepejal Terampai (SS) berpunca daripada hakisan tanah dan mendapan daripada pembangunan kawasan tanah tinggi dan pembukaan tanah untuk pembalakan dan perlombongan. Ia akan mengakibatkan peningkatan SS dan perubahan kepada kualiti air di dalam lembangan sungai.	Suspended Solids	<i>Suspended Solids (SS) is caused by soil erosion and sedimentation from the development in highlands and clearance of land for logging and mining. It is resulted in the increase of SS and affects water quality in the river basins.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Perangkaan alam sekitar	Statistik yang menerangkan keadaan dan arah aliran alam sekitar, meliputi media alam sekitar semula jadi (udara/iklim, air, tanah), biota dalam media dan penempatan penduduk. Perangkaan alam sekitar mengukur aktiviti manusia dan kejadian semula jadi yang membawa kesan kepada alam sekitar, kesan daripada aktiviti-aktiviti dan kejadian ini, reaksi masyarakat kepada kesan alam sekitar dan kualiti kesediaan aset semula jadi. Definisi lengkap termasuk petunjuk alam sekitar, indeks dan perakaunan.	Environment statistics	<i>Statistics that describe the state and trends of the environment, covering the media of the natural environment (air/climate, water, land/soil), the biota within the media, and human settlements. Environment statistics are integrative in nature, measuring human activities and natural events that affect the environment, the impacts of these activities and events, social responses to the environmental impacts, and the quality and availability of natural assets. Broad definitions include environmental indicators, indices and accounting.</i>
Perubahan iklim	Istilah yang kerap digunakan merujuk kepada kepanasan sejagat berkaitan pelepasan gas rumah kaca hasil kegiatan manusia.	Climate change	<i>Term frequently used in reference to global warming due to greenhouse gas emissions from human activities.</i>
R			
Rangka Kerja Pembangunan Perangkaan Alam Sekitar	Konsep rangka kerja bagi membantu membangunkan, menyelaraskan dan menguruskan perangkaan alam sekitar dan perangkaan berkaitan dengan sosial ekonomi dan demografi. Ia dibangunkan oleh United Nations Statistics Division dalam tahun 1984, dan ianya berdasarkan kepada prinsip tekanan-tindak balas impak alam sekitar.	Framework for the Development of Environment Statistics (FDES)	<i>Conceptual framework that assists in development, coordination and organisation of environment statistics and related socio-economic and demographic statistics. It was developed by the United Nations Statistics Division in 1984, and is based on stress-response principles of environmental impacts.</i>
S			
Sinaran global	Jumlah sinaran radiasi elektromagnet yang dipancarkan oleh matahari ke permukaan bumi.	Global radiation	<i>The amount of electromagnetic radiation emitted by the sun to the earth's surface.</i>
Sisa	Aliran bahan pepejal, cecair dan gas, serta tenaga, yang dibuang, dilepaskan atau dikeluarkan oleh pertubuhan dan isi rumah melalui proses pengeluaran, penggunaan atau pengumpulan.	Residuals	<i>Flows of solid, liquid and gaseous materials, and energy, discarded, discharged or emitted by establishments and households through production, consumption or accumulation processes.</i>
Sistem bekas lombong	Sistem untuk menternak ikan di mana-mana tanah yang pernah (tetapi tidak lagi) diberi atau dikeluarkan pajakan lombong atau sijil lombong di bawah mana-mana undang-undang bertulis mengenai perlombongan.	Ex-mining culture system	<i>System of fish culture on any land in respect of which a mining lease or certificate were once but no longer granted or issued under any written law relating to mining.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Sistem kandang	Sistem yang merupakan suatu kepungan yang dibuat daripada bahan pengadang yang dilekatkan pada tiang yang ditanam ke dasar laut.	Pen culture system	<i>System of fish culture in an enclosure made of any screening material attached to poles staked to the seabed.</i>
Sistem kolam	Sistem ternakan ikan di dalam kolam.	Culture system	<i>System of fish culture in ponds.</i>
Sistem sangkar	Sistem untuk menternak ikan di dalam suatu kepungan yang dibuat daripada apa-apa bahan saringan yang diikat pada struktur yang dilabuhkan pada dasar perairan sungai atau mana-mana tempat di darat.	Cage culture system	<i>System of fish culture in an enclosure on whatever shape or size made of any screening material and attached to floating structures which are anchored to the sea-bed.</i>
Sistem tangki	Sistem ternakan ikan di dalam tangki di atas tanah.	Tank culture system	<i>System of fish culture in tanks on land.</i>
Standard kualiti udara	Kepekatan sesuatu bahan cemar yang dibenarkan dalam atmosfera oleh undang-undang untuk meminimumkan kesan mudarat.	Air quality standards	<i>Levels of air pollutants prescribed by regulations that may not be exceeded during a specified time in a defined area.</i>
Subbandar	Stesen pengawasan kualiti udara yang terletak di kawasan pinggir bandar.	Suburban	<i>Air quality monitoring stations located in the suburban areas.</i>
Sulfur Dioksida (SO₂)	Berat, tajam, gas tidak berwarna terbentuk terutamanya oleh pembakaran bahan api fosil. Ia adalah berbahaya kepada manusia dan tumbuh-tumbuhan dan menyumbang kepada keasidan dalam hujan.	Sulphur Dioxide (SO₂)	<i>Heavy, pungent, colourless gas formed primarily by the combustion of fossil fuels. It is harmful to human beings and vegetation and contributes to the acidity in precipitation.</i>

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Taman Laut	Kawasan perairan laut yang dizonkan sejauh dua batu nautika dari tikas air surut terendah, kecuali Pulau Kapas di Terengganu, Pulau Kuraman, Pulau Rusukan Besar dan Pulau Rusukan Kecil di W.P. Labuan yang dizonkan sejauh satu batu nautika dari tikas air surut terendah. Taman Laut ditubuhkan untuk melindungi dan memulihara pelbagai habitat dan hidupan marin akuatik.	Marine Park	<i>Sea zoned area for a distance of two nautical miles from the lowest sea level, except in Kapas Island in Terengganu, Kuraman Island, Rusukan Besar Island and Rusukan Kecil Island in W.P. Labuan. These areas are zoned for a distance of one nautical mile from the lowest sea level. Marine Park is established to protect and conserve various habitats and aquatic marine life.</i>
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TERMA	PENERANGAN	TERMS	EXPLANATIONS
Tanah Bencah-Ramsar	Kawasan yang berpayau, fen, tanah gambut atau berair samada semula jadi atau buatan manusia, kekal atau sementara, mengandungi air yang tidak mengalir, mengalir, air bersih, air tawar atau masin termasuk kawasan perairan laut, di mana dalamnya tidak melebihi enam meter.	Wetland-Ramsar	<i>Areas of marshes, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static, flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres.</i>
Tanah bencah	Kawasan dari lapisan tanah rendah yang mana aras air bumi yang berada atau berhampiran dengan permukaan tanah pada kebanyakan masa. Tanah bencah termasuk semua tanah berpayau, tanah berlumpur, fen dan muara.	Wetland	<i>Area of low-lying land where the water table is at or near the surface most of the time. Wetlands include swamps, bogs, fens, marshes and estuaries.</i>
Tanah berhutan	Tanah yang merangkumi lebih daripada 0.5 hektar dengan pokok-pokok yang lebih tinggi daripada 5 meter dan litupan kanopi melebihi 10%, atau pokok yang mampu untuk mencapai tahap in-situ (FAO 1998; FRA 2000). Ia tidak termasuk tanah di bawah penggunaan tanah pertanian atau bandar (dirian pokok di kawasan pertanian, taman dan sebagainya). Keluasan kawasan berhutan ini dibahagikan kepada Hutan Simpanan Kekal (HSK), Hutan Tanah Kerajaan (HTK), Hutan Hidupan Liar di luar kawasan HSK, lain-lain Rizab Berhutan dan Tanah Bermilik.	Forested land	<i>A land area of more than 0.5 ha. The trees should be able to reach a minimum height of 5 metres with a tree canopy cover of more than 10 per cent. It does not include land under agricultural or urban land use (stand of trees in agricultural areas, parks, etc.). Forested land is divided into permanent forest reserve (PRF), forest land government (FLG), forest wildlife outside the PRF, others forested reserve and alienated land.</i>
Tanaman	Tanaman merujuk kepada tumbuhan atau hasil pertanian yang ditanam untuk makanan atau keperluan ekonomi lain seperti pakaian atau makanan ternakan.	Crops	<i>Crops refer to plants or agricultural produce grown for food or other economic purposes, such as clothes or livestock fodder.</i>
Tanaman buluh	Buluh digunakan secara meluas dalam industri pembuatan perabot, kraftangan, bekas barangan, tikar, pulpa, kertas, bahan bakar, pembinaan dan peralatan rumah.	Bamboo plantation	<i>Bamboo is a widely used in the furniture manufacturing industry, handicrafts, container products, matting, pulp, paper, fuel, and construction as well as home appliances.</i>
Tanaman mengaya	Merupakan suatu rawatan pemulihan hutan ke atas kawasan hutan miskin dan kawasan lapang yang dilaksanakan ke atas kawasan di dalam HSK yang telah diusahakan bagi membantu meningkatkan isi kandungan hutan tersebut supaya mencapai tahap yang dikehendaki.	Enrichment planting	<i>Forest restoration treatments on poor forest areas and open spaces that are performed on the areas in PRF which has been harvested to help improve the content of the forest to reach the desired level.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
Tanaman rotan	Salah satu hasil hutan bukan kayu utama. Bertujuan untuk meningkatkan stok tumbuhan dalam kawasan HSK yang sesuai bagi memastikan pengeluaran sumber ini secara berkekalan untuk menampung keperluan industri perabot rotan tempatan.	<i>Rattan plantation</i>	<i>One of the main non-timber forest products. The plantation is to increase the stock of this plant in the PRF appropriate to ensure sustainable production of these resources to meet the needs of the local rattan furniture industry.</i>
Tanaman tumbuhan ubatan	Spesies tumbuhan yang mempunyai nilai perubatan dan ditanam secara ladang.	<i>Planting of medicinal plants</i>	<i>Species of plants that have medicinal value and cultivated fields.</i>
Tapak pelupusan	Pemindahan terakhir bahan sisa di dalam atau di atas tanah yang dikawal atau tidak dikawal mengikut cara kebersihan yang berbeza, perlindungan alam sekitar dan keperluan keselamatan yang lain.	<i>Landfill</i>	<i>Final replacement of waste in or on the land in a controlled or uncontrolled way according to different sanitary, environmental protection and other safety requirements.</i>
Tapak pelupusan sanitari	Kaedah untuk melupuskan sisa pepejal di atas tanah tanpa menimbulkan gangguan atau bahaya kepada kesihatan awam dan alam sekitar. Berdasarkan prinsip kejuruteraan, sisa pepejal dihadkan kepada kawasan kecil, dikurangkan kepada jumlah yang lebih kecil dan ditutup dengan lapisan tanah pada penghujung waktu operasi setiap hari, atau pada jangka masa yang lebih kerap mengikut keperluan.	<i>Sanitary landfill</i>	<i>A method of disposing of solid wastes on land without creating nuisances or hazards to public health or the environment. Using the principles of engineering, the solid waste is confined to the smallest practical area, reduced to the smallest practical volume and covered with a layer of earth at the conclusion of each day's operation (daily cover), or at more frequent intervals as may be necessary.</i>
Tapak semaian	Menghasilkan anak benih dan anak pokok untuk digunakan bagi projek-projek penghutan semula, penyelidikan, perhutanan bandar dan aktiviti landskap.	<i>Nursery</i>	<i>Produce seedlings and saplings to be used for reforestation projects, research, urban forestry and landscape activities.</i>
Tekanan aras laut	Tekanan udara yang diukur berdasarkan jarak ketinggian dari paras purata aras laut (mengikut ICAO Standard Atmosphere).	<i>Sea level pressure</i>	<i>The air pressure measured based on the altitude distance from the mean sea level according to the ICAO Standard Atmosphere.</i>
Tidak diperolehi	Tiada pencerapan dilaksanakan.	<i>Not available</i>	<i>No observations are performed</i>
Topografi	Bentuk fizikal kawasan permukaan, termasuk muka bumi atau ketinggian relatif dan kedudukan bentuk muka bumi buatan manusia dan semula jadi.	<i>Topography</i>	<i>Physical feature of a surface area, including its relief or relative elevations, and the position of human-made and natural features.</i>

TERMA	PENERANGAN	TERMS	EXPLANATIONS
V			
Viral Hepatitis A	Penyakit akut biasanya termasuk demam, dedar, keletihan melampau, anoreksia, loya, jaundis akut dan kuadran atas kanan abdomen dengan pertambahan lebihan alanine aminotransferase melebihi 2.5 kali kadar biasa.	Viral Hepatitis A	<i>Acute illness typically including fever, malaise, extreme fatigue, anorexia, nausea, acute jaundice and right upper quadrant of abdomen tenderness with raised alanine aminotransferase more than 2.5 times normal rate.</i>

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