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ASEAN
THAILAND 2019
ADVANCING PARTNERSHIP
FOR SUSTAINABILITY

กรมควบคุมมลพิษ
POLLUTION CONTROL DEPARTMENT

Booklet on Thailand State of Pollution 2018

Pollution Control Department
Ministry of Natural Resources and Environment
February 2019

Booklet on Thailand State of Pollution 2018

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Preface

It is a great honour and privilege for Thailand to handover the ASEAN Chairmanship in the year of 2019 to support and push forward ASEAN toward the new ASEAN Economic Community Blueprint (AEC Blueprint 2025). The Pollution Control Department, Ministry of Natural Resources and Environment has main mission to manage pollution problem in Thailand in collaboration with other concerned agencies and networks. We do continuously prevent and solve pollution problems in accordance with the 20 years National Strategy (2018-2037), the National Reform Plan, and the Twelfth National Economic and Social Development Plan (2017-2021) in order to link to Sustainable Development Goals (SDG) and balance in aspects of economy, social, quality of life people living, and preserving natural resources and environment.

This Booklet aims to build understanding among the public and the ASEAN member states regarding the state of pollution and current initiatives of pollution management as well as to seek involvement in solving common issues and pollution problems at the regional level. The Booklet includes the state of surface water quality, coastal water quality, air quality, solid and hazardous waste, and pollution management.

On behalf of the Ministry of Natural Resources and Environment Pollution Control Department would like to take this opportunity, as a host, to mobilize the ASEAN cooperation together the within concept of Thailand's Chairmanship, "Advancing Partnership for Sustainability".

(Mr. Pralong Dumrongthai)
Director General
Pollution Control Department
February 2019

Contents

State of surface water quality and coastal water quality, and Water quality management

State of surface water quality and coastal water quality

In 2018, the overall surface water quality has been improved and remained within fair and good quality. Some water resources in poor quality has become decreased,mostly at the estuaries of the Central Part of Thailand, where municipal, industrial and agricultural waste are gathered.

The results of testing water quality from country's 59 majors rivers and 6 standing water sources showed the results of good, fair and poor water quality index in the proportion of 45%, 43% and 12%, respectively and name of water sources determined excellent and very poor water quality index (as of January – September 2018). In comparing to 2017, the quality of water sources which had consistently between fair level to good level increased from 83% to 88%, whereas that the water sources of poor level decreased from 17% to 12%. Water sources in the Northeastern region have better water quality than other regions, while water sources in the Central region have lower water quality than to other regions. (Table 1 and Figure 1)

Table 1 Surface Water Quality by Region in 2018

Water Quality Index (WQI)	Surface water resources in each region (WQI,DO)					Per-centage
	Northern region	Central region	Northeastern region	Eastern region	Southern region	
 Excellent (91-100)	-	-	-	-	-	0
 Good (71-90)	Mae change(78,4.5)+ Li(73,6.3) Ing(74,5.7) Kok(71,6.0)+ Wang(71,6.2)+ Bueng Boraphet(71,5.8)+	Khwae Noi(83,4.8) Khwae Yai(77,5.0) Kui Buri(76,5.9)+ Upper Phetchaburi (73,5.8) Pran Buri(73,5.5)+	Lam Chee(82,5.8) Songkram(81,4.1) Loei(71,6.2) Nong Han(80,5.9) Oon(85,4.2) Chi(81,5.5)+ Lampao(79,4.9)+ Siew(76,5.2)+ Phong(76,3.8)+ Mun(76,5.1)	Welu(71,4.7)+	Upper Tapi(90,6.9) Phum Duang(78,6.0)+ Upper Pattani(76,5.6)+ Lower Pattani(73,5.2)+ Pak Phanang(72,5.9)+ Songkhla Lake(75,6.3)+ Sai Buri(78,6.5)	45

Table 1 Surface Water Quality by Region in 2018 (continued)

Water Quality Index (WQI)	Surface water resources in each region (WQI,DO)					Per-centage
	Northern region	Central region	Northeastern region	Eastern region	Southern region	
Fair (61-70)	Kwan Phayao(69,6.7) Ping(64,5.3) Nan(63,4.8) Yom(61,5.0)	Upper Chao Phraya(70,5.2) Upper Tha Chin(65,5.4) Central ChaoPhraya(64,3.2) Mae Klong(70,5.2) Pa Sak(67,5.1) Noi(68,4.1) Lower Petchaburi(66,4.6)	Upper Lamtakong(67,6.6)-	Chanthaburi(70,6.1) Trat(66,5.2) Lower Phangrad(63,4.9) Nakhon Nayok(66,3.0)+ Upper Rayong(62,3.0)+ Lower Rayong(62,2.8)+ Bang Pakong(61,3.0) Prasae(69,5.8) Prachinburi(65,4.4)	Chumphon(66,5.8) Trang(65,5.8) Thale Noi(68,3.2)- Thale Luang(68,6.3)- Lower Tapi(70,5.8) Lower Lang Suan(67,6.4)- Upper Lang Suan(65,7.3)-	43
Poor (31-60)	Kuang(58,3.4)	Central Tha Chin(57,3.4) Lower Chao Phraya(37,1.3) Lower Tha Chin(46,3.0) Sakae Krang(59,4.7) Lopburi(59,2.6)	Lower Lamtakong(44,1.0)	Upper Phangrad(49,3.0)	-	12
Very poor (0-30)	-	-	-	-	-	0

Remarks: + shows water sources that had improved by 1 level compared to 2017
- shows water sources that had deteriorate by 1 level compared to 2017

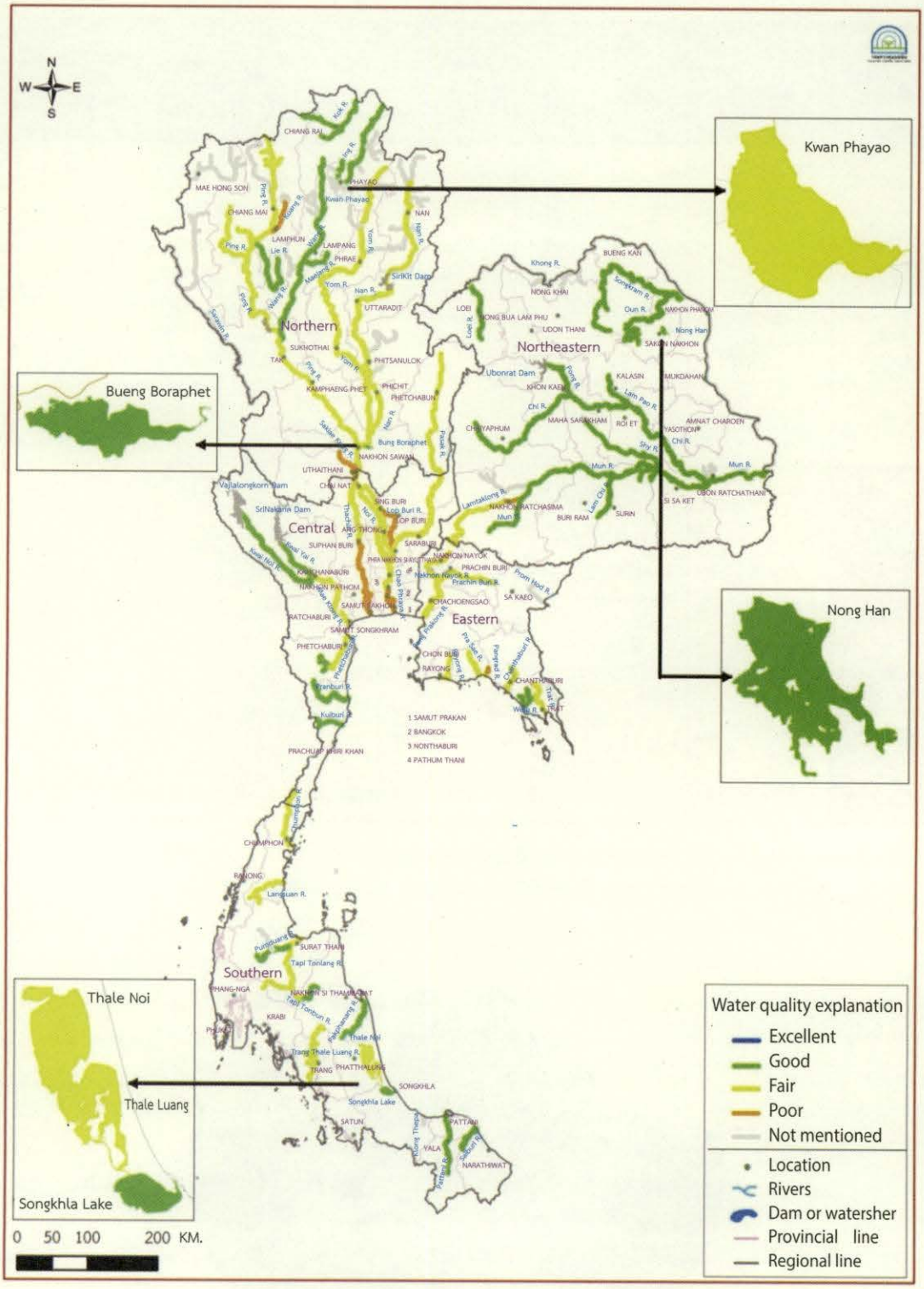


Figure 1 Surface water quality in 2018

The water quality monitoring in 64 provinces are revealed that there are 27 provinces (42%), with good quality, in 29 provinces (45%) with fair quality, and 8 provinces (13%) with poor quality the best water quality is in Nakorn Phanom, while the poor water quality is in the central region (Table 2)

The top five rivers with the best water quality are the Upper Tapi, Oon Khwae Noi, Lam Chee and Songkram. The top five rivers with the poorest water quality are the Lower Chao Phraya, Lower Lamtakhong, Lower Tha Chin, Upper Phangrad and Middle Tha Chin.

Table 2 Ranking Province with Water Quality Index (WQI) from Poor Quality to Good Quality

Ranking	Province	Water Quality Index (WQI)	Water Source
Provinces with poor water quality			
1	Bangkok	35	Chao Phraya
2	Samut Prakan	37	Chao Phraya
3	Samut Sakhon	41	Tha Chin
4	Nonthaburi	48	Chao Phraya
5	Nakhon Pathom	52	Tha Chin
6	Sukhothai	58	Yom
7	Uthai Thani	59	Sakae Krang
8	Suphan Buri	59	Tha Chin
Provinces with fair water quality			
9	Chachoengsao	61	Bang Pakong
10	Phichit	61	Yom, Nan
11	Phetchabun	61	Pa Sak
12	Phitsanuklok	61	Yom, Nan
13	Chiang Mai	62	Ping, Kuang
14	Lamphun	63	Kuang, Li
15	Phra Nakhon Si Ayutthaya	64	Chao Phraya, Pa Sak, Noi, Lop Buri
16	Nakhon Nayok	64	Nakhon Nayok
17	Nakhon Ratchasima	65	Lamtakhong, Mun, Chi
18	Lop Buri	65	Pa Sak, Lop Buri

Table 2 Ranking Province with Water Quality Index (WQI) from Poor Quality to Good Quality (continued)

Ranking	Province	Water Quality Index (WQI)	Water Source
19	Phrae	65	Yom
20	Trang	65	Trang
21	Rayong	65	Rayong, Prasae
22	Chanthaburi	66	Chanthaburi, Phangrad
23	Samut Songkhram	66	Mae Klong
24	Uttraradit	66	Nan
25	Kamphaeng Phet	66	Ping
26	Chumpon	66	Chumphon, Lang Suan
27	Sing Buri	66	Chao Phraya, Noi, Lop Buri
28	Prachin Buri	66	Prachin Buri, Bang Pakong, Nakhon Nayok
29	Pathum Thani	67	Chao Phraya
30	Phetchaburi	67	Phetchaburi
31	Nan	67	Nan
32	Nakhon Sawan	67	Chao Phraya, Ping, Nan, Bueng Braphet
33	Ratchaburi	68	Mae Klong
34	Phayao	68	Kwan Phayao, Ing, Yom, Lop Buri
35	Tak	69	Ping, Wang
36	Trat	70	Welu, Trat
37	Ang Thong	70	Chao Phraya, Noi
Provinces with good water quality			
38	Loei	71	Loei
39	Songkhla	71	Thale Luang, Songkhla Lake
40	Phatthalung	72	Noi, Thale Luang
41	Chai Nat	72	Chao Phraya, Tha Chin, Noi, Sakae Krang
42	Chiang Rai	73	Kok, Ing
43	Surat Thani	73	Tapi, Phum Duang

Table 2 Ranking Province with Water Quality Index (WQI) from Poor Quality to Good Quality (continued)

Ranking	Province	Water Quality Index (WQI)	Water Source
44	Buriram	74	Mun, Lam Chee
45	Pattani	74	Pattani, Sai Buri
46	Lampang	74	Wang, Chang
47	Nakhon Si Thammarat	74	Pak Phanang, Tapi
48	Prachuap Khiri Khan	74	Pran Buri, Kui Buri
49	Yasothon	74	Chi
50	Saraburi	75	Pa Sak
51	Roi Et	76	Chi, Siew
52	Yala	77	Pattani, Sai Buri
53	Khon Kaen	77	Phong, Chi
54	Si Sa Ket	78	Mun, Siew
55	Ubon Ratchathani	78	Mun, Chi
56	Narathiwat	78	Sai Buri
57	Chaiyaphum	79	Chi
58	Kalasin	79	Lampao
59	Kanchanaburi	79	Mae Klong, Khwae Yai, Khwae Noi
60	Sakon Nakhon	81	Nong Han, Oon, Songkhram
61	Surin	81	Mun, Lam Chee
62	Maha Sarakham	81	Chi, Siew
63	Bueng Kan	82	Songkhram
64	Nakhon Phanom	84	Oon, Songkhram

Within the past 10 years (2009-2018), of most water sources have fair water quality. At present, water source of excellent water quality have not found. None of water sources of very poor quality have been determined since 2009. These have moved fowards the change of good water quality. (Figure 2)

The water sources which always maintain good quality are Upper Tapi, Khwae Noi and Lum Chee. On the other hand, there are also some sources that tend to have continuously poor water quality, and require closly monitoring and problem solving, which are the Lower Chao Phraya, Lower Tha Chin, Lop Buri and Lower Lumtakong.

Figure 2 State of surface water quality countrywide, 2009-2018

Most of the coastal water quality are good and fair. While tourist beaches have excellent coastal water quality. However, water quality in some coasal areas are continuously defined as poor quality especially in the Inner Gulf of Thailand.

The proportion of coastal water quality in 2018 are 1% excellent, 58% good, 35% fair, 5% poor and 1% very poor levels. (Figure 3)

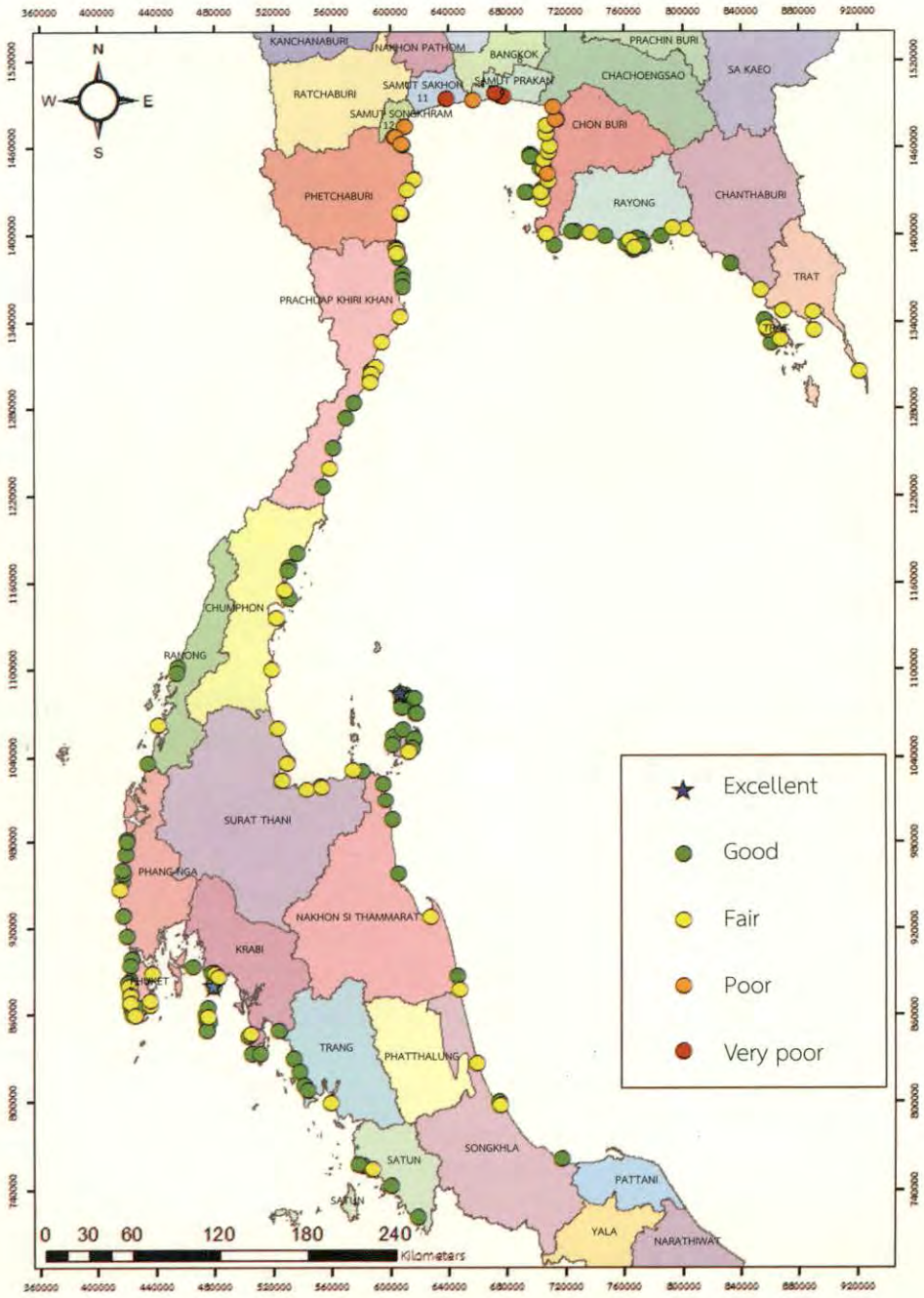


Figure 3 Coastal water quality in 2018

In 2018, Koh Ma Island in Surat Thani province and Thale Waek beach in Krabi province reach the excellent coastal water quality criteria. On the other hand, the areas where the coastal water quality is contiuously poor or very poor are Inner Gulf of Thailand connected to main estuaries: Chao Phraya, Tha Chin and Mae Klong.

Within the past 10 years (2009-2018). the coastal water quality was inclined to be of poor quality during 2009-2013. Subsequently 2014 to present, the coastal water quality has been improved and 94% is of fair, good and very good quality. (Figure 4)

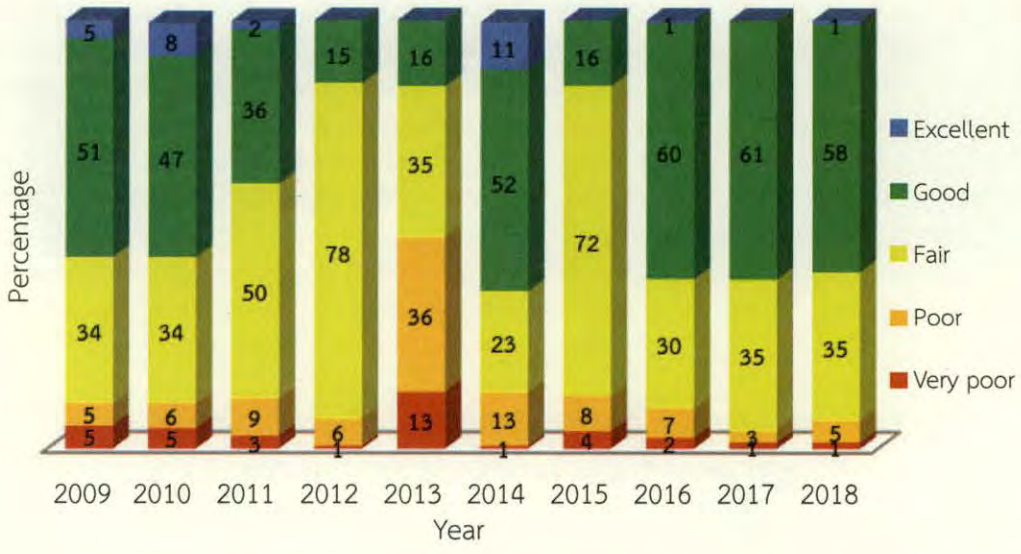


Figure 4 State of coastal water quality countrywide, 2009-2018

Insufficient efficiency of domestic wastewater management and wastewater discharge from pollution sources have affected surface water and coastal water quality.

The major cause of poor surface water and coastal water quality is population growth. Additionally, wastewater discharge from pollution sources, come from community business, industrial factories and agricultural activities. These activities discharge wastewater into water resources and water quality in under standard. The total volume of the discharge of wastewater is over carrying capability of water sources in critical river basin area, main canals, and tourist attraction. Wastewater management under Local Administration Organizations is limited due to insufficient efficiency of central domestic wastewater treatment, plants which are unable to collect all wastewater to the treatment system. Moreover, increasing of activities in at industrial secters, ports, tourist attractious, aquacultures, and direct dischange to coastal areas have affected, coastal water deterionation, and 22 instance of red tide phenomenon, in 2018, both at the Andaman Coast and the Gulf of Thailand.

Water quality management

Formulate the National Water Quality Management Plan

The conceptual of 20-years National Water Quality Management Plan (2018 - 2037) consists of balancing among economy, social and environment for sustainable development; precautionary principle and controlling wastewater discharge according to carrying capacity of water sources; applying emission permit system, Polluter Pays Principle (PPP); reducing water usage and wastewater pollution with environmentally friendly production in househole, industrial and agriculture secter; providing wastewater system in the critical areas and economic cities; set up a standard of water pollution loading based on carry capacity in each area and pollution permit system; formulate appropriate guideline and procedures for water quality conservation fees collection in order to wastewater treatment system, manage water quality (free for wastewater management) including promote public, entrepreneurs, private sector to follow the regulations strictly and participate in Corporate Social Responsibility: CSR activities regarding water quality conservation.

Control waste water discharge from sources

1. Domestic wastewater management

1.1 21 million households or 66 million people have generated 9.7 million cubic meters of wastewater per day. This wastewater is managed by 105 central municipal wastewater treatment plants, operated by Local Administration Organizations and the Wastewater Management Authority. At present 95 treatment plants are operated with a capacity of 2.6 million cubic meters per day (27% of total wastewater per day). Recommendation and support Local Administration Organizations In construction more wastewater treatment system and operation as well as improveing wastewater system efficiently are taking into account. (Figure 5)

1.2 Houses and all buildings are required to install wastewater treatment system as a primary treatment to reduce the dirtiness of the wastewater before discharge into water sources.

Location of central wastewater treatment system in Thailand

Northern Region

Wastewater treatment system already constructed and operated (13)

1. City Municipality of Chiang Mai	(DPT) (AL)	55,000	m³/D
2. City Municipality of Nakhon Sawan(MNRE) (MSBR)		36,000	m³/D
3. City Municipality of Chiang Rai	(DPT) (AL)	27,200	m³/D
4. City Municipality of Lampang	(MOST) (SP)	24,600	m³/D
5. Town Municipality of Kamphaeng Phet(MOST) (SP)		13,500	m³/D
6. Town Municipality of Mae Sod, Tak Province(MOST) (SP)		1,000	m³/D
7. Town Municipality of Lamphun (MOST) (SBR)		10,000	m³/D
8. Town Municipality of Phayao	(DPT) (SP)	9,700	m³/D
9. Town Municipality of Sukhothai Thani(MOST) (SP)		8,400	m³/D
10.Town Municipality of Nan	(MOST) (SP)	8,259	m³/D
11.Town Municipality of Taphan Hin, Phichit Province	(MNRE) (SP)	7,164	m³/D
12.Town Municipality of Tak	(MOST) (SP)	5,400	m³/D
13. Subdistrict Municipality of Salok Bat, (DPT) (SP) Kamphaeng Phet Province		500	m³/D
Subtotal		216,723	m³/D

Wastewater treatment system out of order (3)

1. City Municipality of Phitsanulok	(DPT) (SP)	25,000	m³/D
2. Town Municipality of Chumsang, Nakhon Sawan Province	(MOST) (SP)	1,650	m³/D
3. Town Municipality of Phichit	(DPT) (AL)	12,000	m³/D
Subtotal		38,650	m³/D

Wastewater treatment system cancelled (1)

1. Town Municipality of Uthai Thani,	(DOPA)+(MOST)(SP)	2,900	m³/D
Total		258,273	m³/D

Northeastern Region

Wastewater treatment system already constructed and operated (20)

1. City Municipality of Khon Kaen	(DPT+MNRE (MOST)(AL)	78,000	m³/D
2. City Municipality of Nakhon Ratchasima	(DPT)(SP+OD)	70,000	m³/D
3. City Municipality of Udon Thani	(MNRE)(SP)	46,950	m³/D
4. City Municipality of Ubon Ratchathani	(DPT)(AL)	22,000	m³/D
5. Town Municipality of Warin Chamrab, Ubon Ratchathani Province	(MOST)(SP)	22,000	m³/D
6. City Municipality of Sakon Nakhon (Khu Mak Suai)	(Fisheries+DPT) (SP+CW)	16,200	m³/D
7. Town Municipality of Kalasin	(MNRE)(AL)	14,400	m³/D
8. Town Municipality of Surin	(MNRE)(SP)	13,597	m³/D
9. Town Municipality of Buri Ram	(DPT)(AL)	13,000	m³/D
10.Town Municipality of Amnat Charoen	(MOST)(SP)	12,819	m³/D
11.Town Municipality of Pak Chong, Nakhon Ratchasima Province	(MOST)(SP)	12,000	m³/D
12.Town Municipality of Mukdahan	(MNRE)(SP)	8,500	m³/D
13.Town Municipality of Yasothon	(MOST)(SP)	7,246	m³/D
14.Town Municipality of Chaiyaphum	(MNRE)(SP)	6,000	m³/D
15.Town Municipality of Maha Sarakham	(MNRE)(SP)	4,200	m³/D
16.Town Municipality of Bua Yai, Nakaon Ratchasima Province	(DOPA)(SP)	3,000	m³/D
17.Subdistrict Municipality of Tha Rae, Sakhon Nakhon Province	(MNRE)(SP)	2,054	m³/D
18.Subdistrict Municipality of Kosumphisai, Maha Sarakham Province	(MNRE)(SP)	1,500	m³/D
19.Subdistrict Municipality of Tha Toom, Surin Province	(MNRE)(SP)	360	m³/D
20.Subdistrict Municipality of Kud Jic, Nakhon Ratchasima Province	(MNRE)(SP)	400	m³/D
Subtotal		354,226	m³/D

Wastewater treatment system cancelled (1)

1. Town Municipality of Nakhon Phanom	(MNRE)(SP	8,600	m³/D
Total		362,826	m³/D

Eastern Region

Wastewater treatment system already constructed and operated (15)

1. Pattaya City, Chon Buri Province - North Na-Klue	(MOST)(AS)	65,000	m³/D
- South Soi Wat Boon Kanchanaram	(DPT)(AS)	43,000	m³/D
2. Subdistrict Municipality of Laem Cha Bang, Chon Buri Province	(DPT)(OD)	25,000	m³/D
3. Town Municipality of Chachoengsao	(DPT)(OD)	24,000	m³/D
4. Chon Buri Provincial Administration Organization	(DPT)(OD)	22,500	m³/D
5. Town Municipality of Sri Racha, Chon Buri Province	(DPT)(OD)	18,000	m³/D
6. Town Municipality of Chanthaburi	(DPT)(SP)	17,000	m³/D
7. Town Municipality of Map Tha Phut, Rayong Province	(MNRE)(AL)	15,000	m³/D
8. Town Municipality of San Suk, Chon Buri Province - Northern area	(DPT)(OD)	14,000	m³/D
- Southern area	(DPT)(OD)	9,000	m³/D
9. Subdistrict Municipality of Ban-Phay, Rayong Province	(DPT)(OD)	8,000	m³/D
10.Town Municipality of Phanat Nikhom, Chon Buri Province	(DPT)(SP)	5,000	m³/D
11.Subdistrict Municipality of Bang Khla, Chachoengsao Province	(MNRE)(SP)	5,000	m³/D
12.Town Municipality of Khlung, Chanthaburi Province	(MOST)(SP)	4,500	m³/D
13.Subdistrict Municipality of Bang Sa Ray, Chon Buri Province	(MNRE)(SP)	4,400	m³/D
Subtotal		279,400	m³/D

Wastewater treatment system out of order (1)

1. City Municipality of Rayong	(DPT)(AL)	41,000	m³/D

Wastewater treatment system cancelled (1)

1. Samut Prakan Province	(MOST)(AS)	525,000	m³/D
Total		845,400	m³/D

Central Region

Wastewater treatment system already constructed and operated (28)

1. City Municipality of Nakhon Pathom	(DPT)(SP)	60,000	m³/D
2. City Municipality of Nonthaburi	(DPT)(OD)	38,500	m³/D
3. City Municipality of Nakhon Si Ayutthaya	(DPT)(OD)	24,000	m³/D
4. Town Municipality of Kanchanaburi	(DPT)(OD)	24,000	m³/D
5. Town Municipality of Ratchaburi	(DPT)(OD)	20,000	m³/D
6. Town Municipality of Cha-am, Phetchaburi Province	(DPT)(AL)	17,000	m³/D
7. Town Municipality of Hua Hin (Phase 2), Prachuap Khiri Khan Province	(DPT)(OD)	17,000	m³/D
8. Town Municipality of Hua Hin (Phase 1), Prachuap Khiri Khan Province	(DPT)(RB)	8,000	m³/D
9. Town Municipality of Saraburi	(DPT)(OD)	13,000	m³/D
10.Town Municipality of Suphan Buri	(DPT)(SP)	11,400	m³/D
11. Town Municipality of Pathum Thani	(DPT)(OD)	11,000	m³/D
12. Town Municipality of Phetchaburi	(ORDPB)(SP)	10,000	m³/D
13. Town Municipality of Ang Thong	(DPT)(AL)	8,200	m³/D
14. Town Municipality of Prachuap Khiri Khan	(DPT)(AL)	8,000	m³/D
15. Town Municipality of Chai Nat	(DPT)(AL)	7,239	m³/D
16. Town Municipality of Ban Pong, Ratchaburi Province	(DPT)(SP)	5,000	m³/D
17.Town Municipality of Photharam, Ratchaburi Province	(DPT)(OD)	5,000	m³/D
18. Town Municipality of Sing Buri	(DPT)(SP)	4,500	m³/D
19. Town Municipality of Ban Mi, Lop Buri Province	(DOPA)(SP)	1,000	m³/D
20. Subdistrict Municipality of U Thong, Suphan Buri Province	(DPT)(SP)	5,500	m³/D
21. Bangkok Metropolitan			
- Din Daeng	(AS)	350,000	m³/D
- Chong Nonsi	(AS)	200,000	m³/D
- Nong Khaem	(AS)	157,000	m³/D
- Chatuchak	(AS)	150,000	m³/D
- Bang Sue	(AS)	120,000	m³/D
- Thung Khru	(AS)	65,000	m³/D
- Rattanakosin	(AS)	40,000	m³/D
- Si Phraya	(AS)	30,000	m³/D
Subtotal		1,410,339	m³/D

Wastewater treatment system out of order (2)

1. Subdistrict Municipality of Phra Intharacha, Phra Nakhon Si Ayutthaya Province	(MOST)(AS)	4,500	m³/D
Total		1,414,839	m³/D

Southern Region

Wastewater treatment system already constructed and operated (19)

1. City Municipality of Had Yai, Songkhla Province	(MOST)(SP+CW)	138,000	m³/D
2. City Municipality of Phuket	(DPT)(OD)	36,000	m³/D
3. City Municipality of Songkhla	(DPT)(AL)	35,000	m³/D
4. City Municipality of Nakhon Si Thammarat	(MNRE)(SP+CW)	33,700	m³/D
5. Town Municipality of Pa Thong, Phuket Province	(DPT)(OD+AS)	23,250	m³/D
6. City Municipality of Trang	(DPT)(AL)	17,700	m³/D
7. City Municipality of Krabi	(DPT)(AL)	12,000	m³/D
8. Town Municipality of Thung Song, Nakhon Si Thammarat Province	(MNRE)(Fix film and AS)	10,000	m³/D
9. Subdistrict Municipality of Koh Samui, Surat Thani Province			
- Lamai Beach	(DPT)(OD)	8,650	m³/D
- Chaweng Beach	(DPT)(OD)	6,000	m³/D
- Nong Khaem	(DPT)(OD)	2,400	m³/D
10. Subdistrict Municipality of Kra Thu, Phuket Province	(MNRE)(OD)	6,100	m³/D
11. Subdistrict Municipality of Karon, Phuket Province	(MOST)(AS)	6,000	m³/D
12. City Municipality of Yala			
- Bridge in front of Yala Temple	(MNRE)(AL)	4,600	m³/D
- Swamp behide rubber plant	(MNRE)(AL)	3,200	m³/D
13Cheung Talay Subdistrict Administration Organization (SAO), Talang District, Phuket Province			
- Bang Thao Beach	(MNRE)(AS)	2,895	m³/D
- Surin Beach	(MNRE)(AS)	1,667	m³/D
14. Ao Nang Subdistrict Administration Organization (SAO), Koh Phee Phee, Krabi Province	(DNIDA)(SP)	400	m³/D
15. Subdistrict Municipality of Ban Tai Koh Pha Ngan District, Surat Thani Province	(SAO), (TAT)(CW)	200	m³/D
Subtotal		347,762	m³/D

Wastewater treatment system out of order (2)

1. Town Municipality of Pattani	(DPT)(SP)	27,000	m³/D
2. Town Municipality of Chumphon	(DPT)(SP)	12,000	m³/D
Subtotal		39,000	m³/D
Total		386,762	m³/D

Remark s : Sources of budget for the wastewater treatment system construction

- MOST = Ministry of Science and Technology
- DPT = Department of Public Works and Town & Country Planning
- TAT = Tourism Authority of Thailand
- DOPA = Department of Provincial Administration
- MNRE = Ministry of Natural Resources and Environment
- DOF = Department of Fisheries
- DNIDA = Danish International Development Agency
- CM = City Municipality - SM = Subdistrict Municipality
- TM = Town Municipality - SAO = Subdistrict Administration
- PAO = Provincial Administration Organization

Summary : The wastewater treatment systems already constructed and in the process of operation		95
Out of order		7
cancelled		3
Total		105

Figure 5 Status of Central Wastewater Treatment System in Thailand

1.3 Large buildings such as hotels, condominiums, hospitals, department stores, markets, restaurants, schools, dormitories and office buildings are required to install wastewater treatment system and treat wastewater in accorsauce with the standards. Monitoring and law enforcement are implemented regularly to control wastewater treatment, especially in critical river basin areas, main canals and attractive beaches. The results from the survey reveals that 62% of large buildings abide by the law.




2. Industrial wastewater management

2.1 General standards to control water discharge from industries, industrial estaes and industrial zone, as well as specific standards industries, such as producing fresh water from seawater reverse osmosis plants, leather factories pulp and paper factories are issued.

2.2 Industries that achieve the standard in wastewater management factories, both in production processes and discharge line are by transfering clean technology in order to reduce waste, tap water and raw materials, energy and green house gas or CO_2 in industries, such as dyeing and textile, pulp and paper, tea, coffee & beverages, as well as small and medium enterprises (SMEs). Deep-dive recommendations are provided to make green industry. From 2011-2018, about 34,000 factories have been certified as green industry factories.

2.3 Industries that generate a large amount of wastewater should install parameter equipment or tools to measure Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), as well as to ensure their wastewater treatment to meet the standard, with reporting through computer networks.

3. Agricultural wastewater management

3.1 Standards for controlling water discharge from pig farms and aquaculture are formulate. Monitoring system are also implemented to ensure that wastewater treatment operations are operated within the standard.

3.2 Aquaculture farmers are supported to have efficiently wastewater management and eco-friendly production. Currently, there are 18,118 aquaculture farms with Good Aquaculture Practice (GAP) certification.

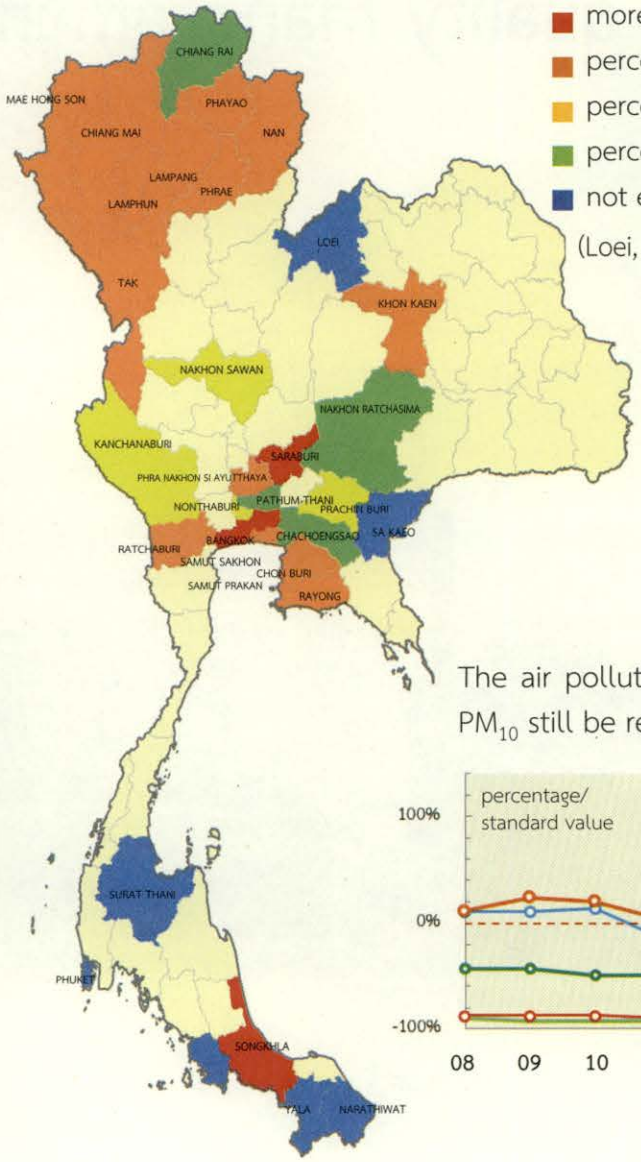
3.3 The "Farm Rak Sing Waed Lom" Project (environmentally friendly farm) has been launched to develop and stimulate farmers' consciousness to manage environment of pig farms, including waste treatment and recycling to reduce impact of stench and polluted water problems, as well as farmers and local officers' potential on applying guideline and code of practies in pig farm environmental.

State of air quality and Air quality management

State of air quality

Overall, air quality in 2018 has been steady state. However, there are main air pollutants that still exceed the standard due to particulate matter less than 2.5$^{\mu m}$ (microns) in diameter ($PM_{2.5}$), Ozone, and particulate matter less than 10$^{\mu m}$ (microns) in diameter (PM_{10}).

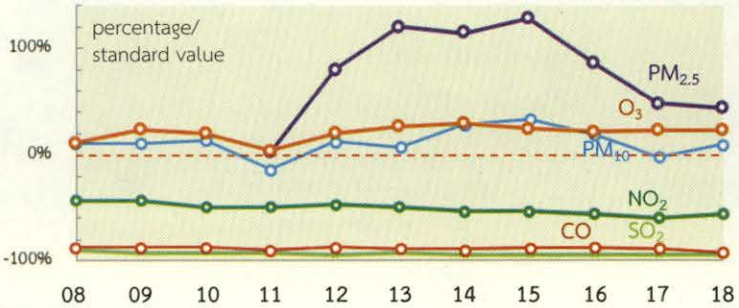
Overall ambient air quality from automatic air quality monitoring stations, in 33 provinces (63 stations), reveal that there are percentage of days in 2018 which the 24-hours average exceeded the standard.



- more than percentage 20 — 4 provinces
- percentage 11-20 — 14 provinces
- percentage 6 -10 — 4 provinces
- percentage 1 - 5 — 4 provinces
- not exceed standard — 7 provinces

(Loei, Sa Kaeo, Surat Thani, Phuket, Satun, Yala, Narathiwat)

The air pollution steady except $PM_{2.5}$, Ozone and PM_{10} still be resolved



Particulate matter in diameter less than 2.5 μm (micron) ($PM_{2.5}$) The 24 hours average value was in the range of 3-133 micrograms per cubic meter (standard value: 50). Annual average value was between 9-41 micrograms per cubic meter. And the countrywide average value was 24 micrograms per cubic meter (standard value: 25). Since 2015, $PM_{2.5}$ had a tendency to be decreasing. While in 2018 the concentration of $PM_{2.5}$ has increased (Figure 6).

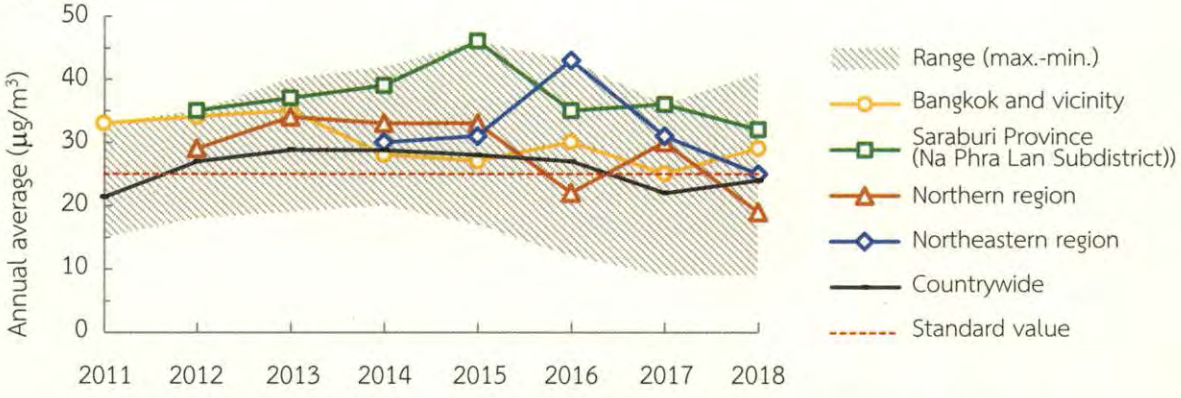


Figure 6 The annual average of concentration of $PM_{2.5}$ (2011-2018)

Ozone (O_3) The maximum 1- hour average value of ozone from each stations was at 123 parts per billion, with maximum value at 193 parts per billion (standard value: 100). The maximum 8 hours average value from each station was at 97 parts per billion, with maximum value at 149 parts per billion (standard value: 70). Overall, ozone values still exceed the standard, and have been steady state from last year (Figure 7).

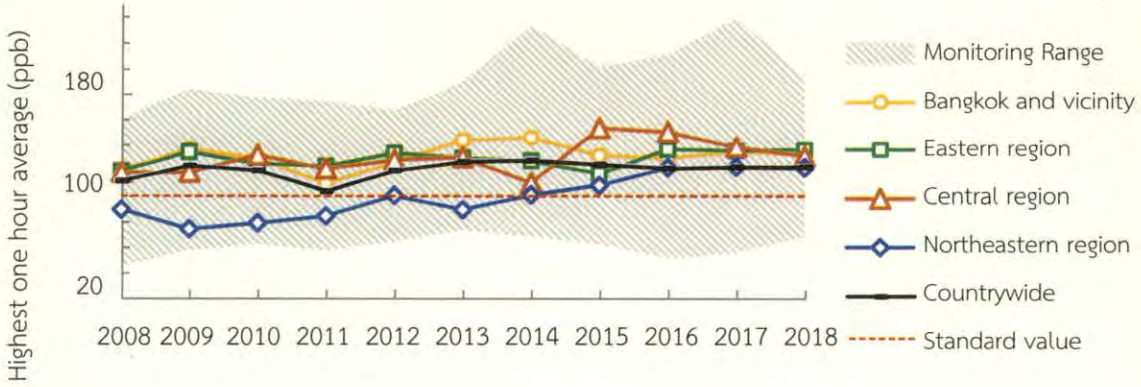


Figure 7 The annual average of ozone (maximum 1- hour average in 2008-2018)

Particulate matter with diameter less than 10 micron (PM_{10}) The 24 - hour average value was in the range of 2-303 micrograms per cubic meter (standard value: 120). The annual average value was between 23-120 micrograms per cubic meter.The countrywide average value was 42 micrograms per cubic meter (standard value 50). PM_{10} has a tendeucy to be increasing in Na Phra Lau Subdistrict, Saraburi Province (Figure 8).

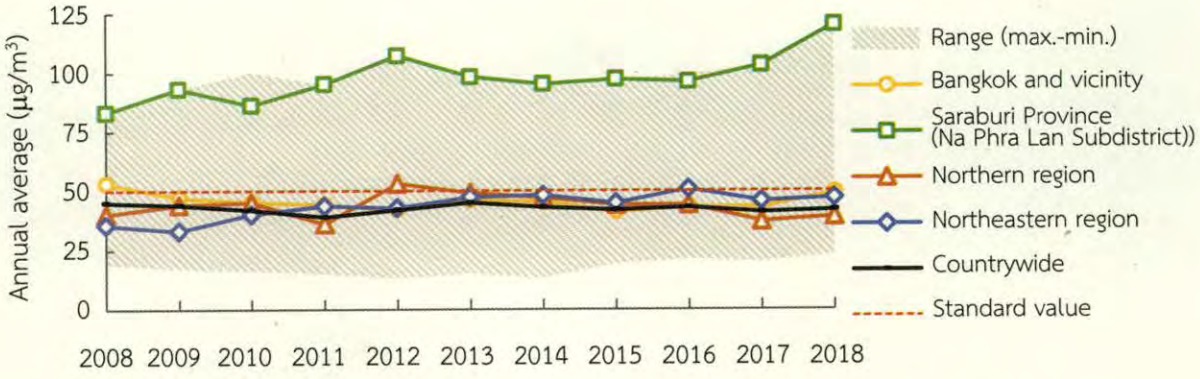


Figure 8 The annual average of concentration of PM_{10} in 2008 – 2018.

Volatile Organic Compounds (VOCs) The annual average value was in the range of 1.3 – 4.7 micrograms per cubic meter. There were 4 out of 7 monitoring provinces where the values had been exceeded the standard. The average values have been decreased continuously since 2014. While in 2018, the pollutants have been increased gradually (Figure 9).

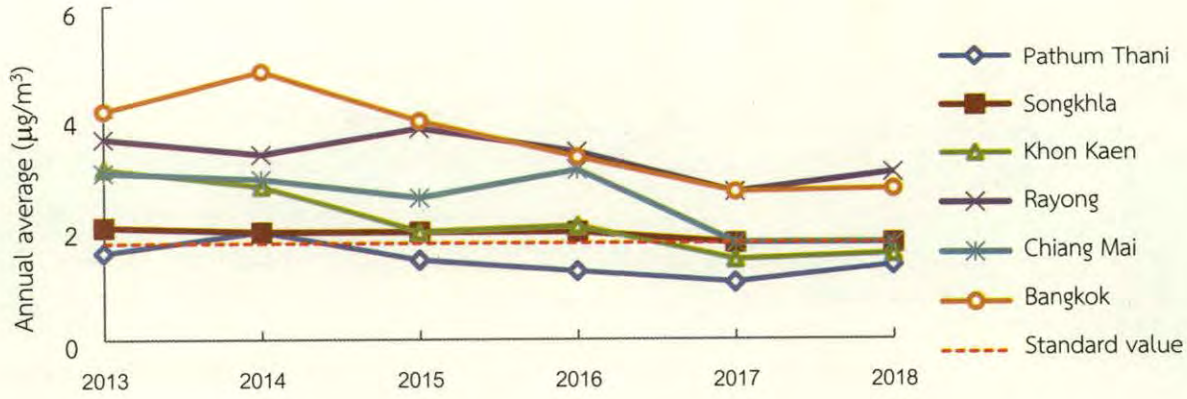


Figure 9 The annual average of benzene in the atmosphere comparing within 6 provinces in 2013-2018

Nitrogen dioxide, Sulfur dioxide, Carbon monoxide (No_2, So_2, CO)

These pollutants have been found within the standard in all measured areas.

Air pollution sources

Meteorological factors

During the dry season, there is the air stagnation phenomenon and high air pressure has spread over in Thailand, which results in a large accumulation of air pollution in the area. In February, air pollution has been measured high volume on several consecutive day in central region of Bangkok and vicinity Thailand. In northern region of Thailand, the phenomenon has been found continuously until March and air quality will improved in the monsoon season.

Point Sources factor

High levels of $PM_{2.5}$ has been found in large cities with heavy traffic, open burning of agricultural materials, and industrial areas. PM_{10} has been generated by building and road construction. Sulfur dioxide mainly results from industrial activities while Volatile Organic Compounds come from gas stations and usage of chemicals and solvents, etc. (Figure 10)

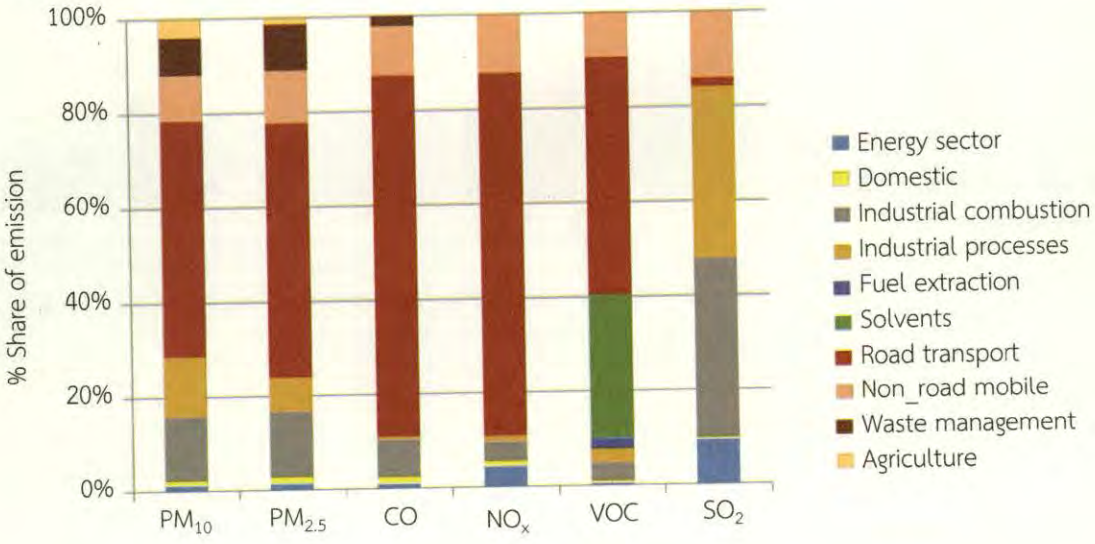


Figure 10 The study report of air pollution sources in Bangkok and vicinity
Source: Development of Thailand's gridded air pollution emission inventory for use in Air Quality Models 2018 by researcher team of King Mongkut's University of Technology Thonburi.

State of air pollution in critical areas: The haze problem in the Northern Thailand has been improved, while intensive corrective measures are still needed to solve the problem in Bangkok and areas in the Na Phra Lan Subdistrict, Saraburi province.

State of haze problems in 9 provinces of Northern Region.

The major causes are open burnings and forest fires, and the situation has improved since 2016. The number of days with particulate matter exceeded the standards has been to decreased continuously from 61 days in 2016, 38 days in 2017 to be 34 days in 2018 (decreased 44% and 11%, respectively). The hotspots accumulation has been decreased, from 10,133 hotspots in 2016 and 5,418 hotspots in 2017, and to be 4,722 hotspots in 2018 (decreased 53% and 13%) the major factor that resolves the situation is the collaboration and integration of each relevant organization. The integrations has been led by the Ministry of Interior, under the Public Disaster Prevention and Mitigation Act, B.E. 2550 protocol, and has been managed using the Single Command method by the Governors (Figure 11).

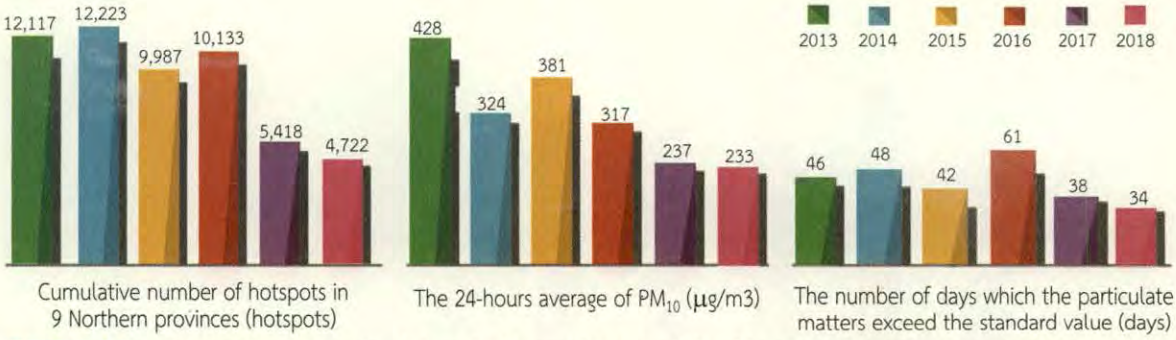


Figure 11 The state of haze problem in 9 provinces of the Northern Region, from 2013-2018 (During January 1 – May 31 of each year)

Paticulate matters PM_{10} in Na Phra Lan Subdistrict, Saraburi Province.

The major cause of PM_{10} problem in the area is a diffusion of porticulate matter from cement plants, lime plants, stone crushing plants, quarries in the area and nearby, as well as traffic congestion transportation and logistics activity in the area where roads are damaged. The 24 - hours average of particulate matter has excceded intermittently the standard, especially during dry season (from October – December and January – March of each year). In 2018, the number of days that PM_{10} has the exceeded standard values were 165 days from 362 monitoring days (46%), which increased 27% from 2017. The 24 - hours average value was at 27 – 303 micrograms per cubic meter (Standard value 120) The annual average value was 119.5 micrograms per cubic meter (Standard value: 50), which is higher than 2017 where the figure was at 103.2 micrograms per cubic meter (Figure 12).

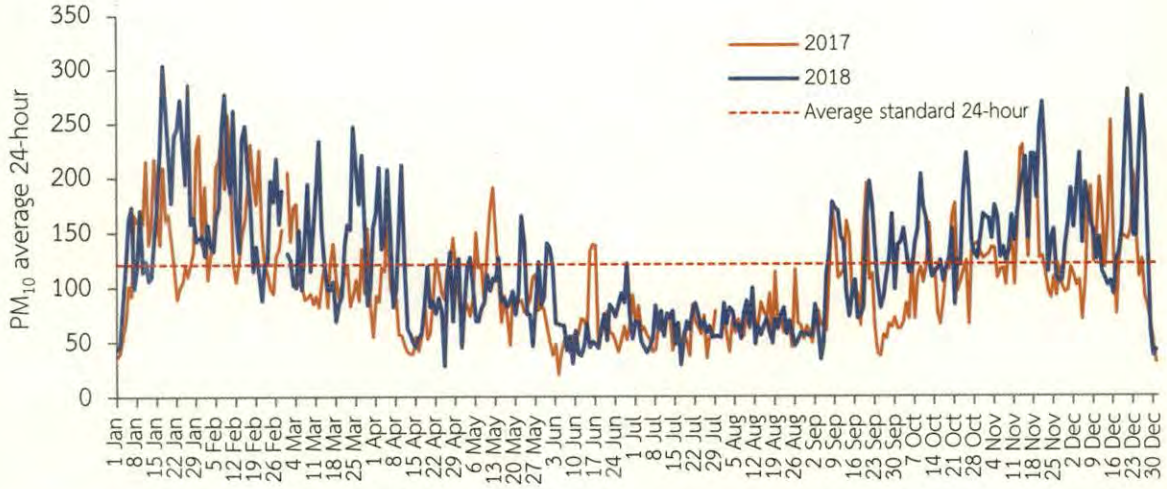
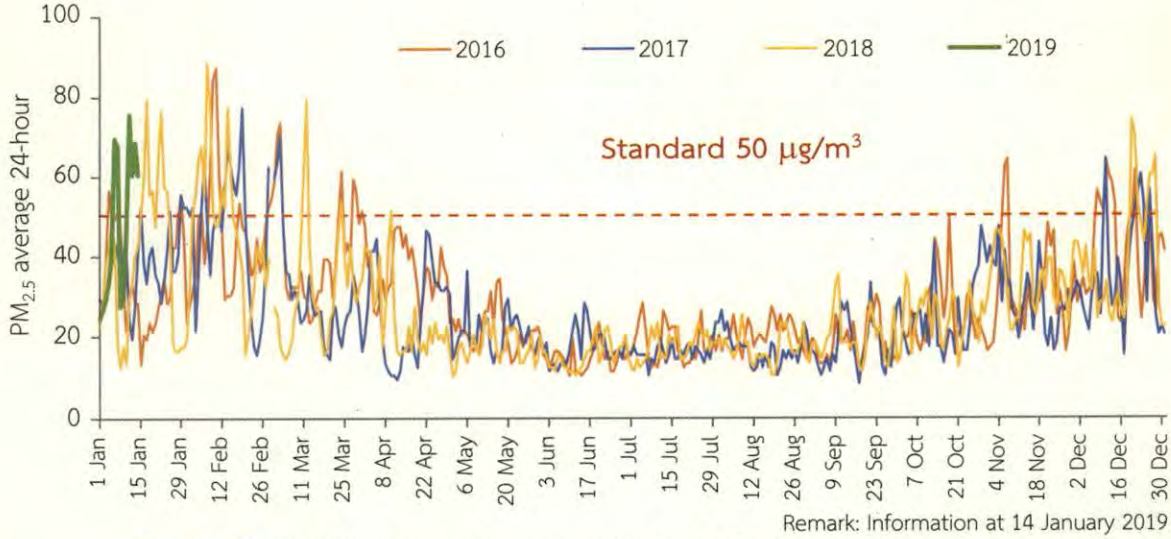


Figure 12 The 24-hours average value of particle matter in the Na Phra Lan Subdistrict, Saraburi in 2017-2018

$PM_{2.5}$ in Bangkok and vicinity

During early (January – March) to late (December) period of each year, there is the accumulation of $PM_{2.5}$ in the atmosphere. The main sources is vehicles, inaddition to meteorological conditions of not - circulating are and no wind speed. Due to high pressure cover Upper Thailand, the weakness of air temperatures and meteorological condition affect Bangkok and receiving. The accumulation of $PM_{2.5}$ is then exceeded the standards in 2018, during January – February 2018, and during December 2018 – January 2019 (Figure 13).



Remark: Information at 14 January 2019

Figure 13 The 24 - hours average value of particulate matter less than 2.5 μm (micron) in diameter ($PM_{2.5}$) in Bangkok from 2016 – 2019

Volatile Organic Compounds (VOCs) in Map Ta Phut and nearby areas, Rayong province

The average value of 3 types of VOCs were higher than annual standard values. **1,2-Dichloroethane** slightly has been improved compared to last year, but was still higher than its standard. **Benzene** has found higher than last year. The surveillance value of its concentration (24-hours) still exceed the surveillance value in February, July, September and December. **1,3-Butadiene** concentration were found higher and exceed the surveillance value than last year, especially in the Northern and Northeastern areas of Map Ta Phut industrial estate in July, August and September. The high concentration of VOCs was the cause of using/producing these vocs in chemical industries. (Figure 14)

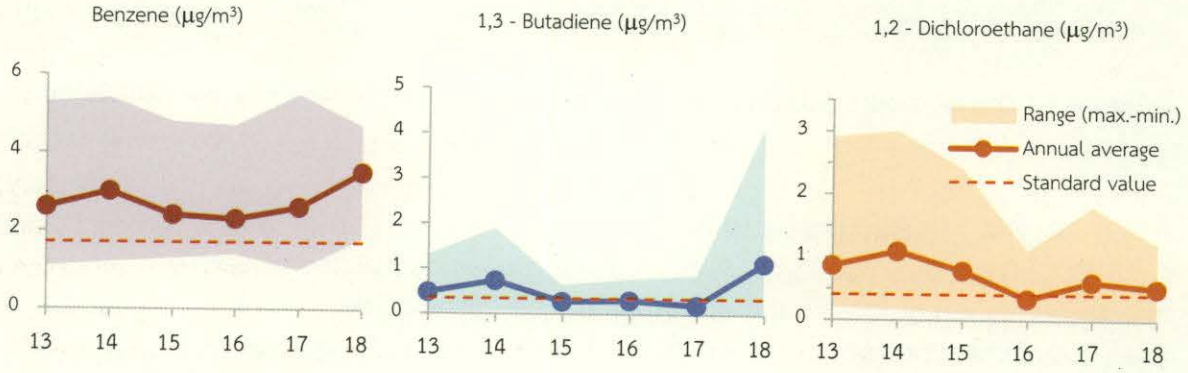
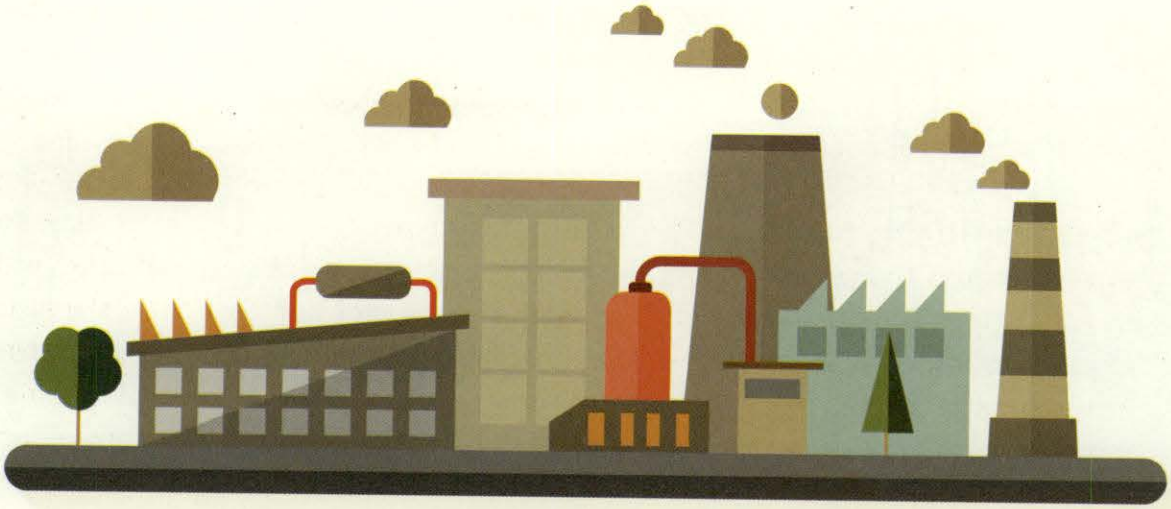


Figure 14 The concetration of Benzene, 1, 3-Butadiene, and 1, 2-Dichloroethane in the atmosphere in Map Ta Phut and nearby area, Rayong province.



Air Quality Management

Set the Air Quality Management plan

Create a master plan for the Air Quality Management for a 20 years period (2018-2037), which will adopt a framework that balances economic, social and environmental concerns. Include impact prevention and proactive prevention, which aim to reduce pollution by elevating the standards of exhaust for new vehicles, together with an improvement in fuel quality. Launch zero emission regulations for new vehicles to promote the usage of electric vehicles and public electric trains Encourage high pollution-generating industrial factories to adopt an eco-industrial system and green industrial standards. Promote burn-less agricultural activities. Enforce pollution control from the source of origin by setting the standard controlling emissions in terms of loading capacity and capability of the area to handle the emissions (carrying capacity), as well as enact an emission permit system. Set measures of traffic and/or vehicle volume in heavy traffic areas of cities when in crisis. Accelerate pollution problem solving which is still necessary in specific areas. Improve air quality and pollution monitoring systems to cover all provinces across the country, in order to decentralize the measurement to a local authority, and then gather results and submit them to the central air quality reporting system.

Set standard of air quality in the atmosphere and emission from source of origin

1. Set standards of air quality in the atmosphere in general, in order to maintain the quality of the nation's environment and the population's health, which covers baseline pollutants, such as particulate matter, sulfur-dioxide, nitrogen-dioxide, ozone and carcinogenic substances (e.g. VOCs and toxins such as carbon-disulfide).

2. Set emission controlling standard from sources of origin to prevent any impact to the environmental quality, which include emission controlling standards for Benzene-engines and small and large diesel engine vehicles, including automobiles with gas fuel systems, motorbikes and tricycle cars. Also set emission controlling standards for power plants, solid waste incinerators, infectious waste incinerators, stone crushing plants, cement plants, fuel depots, chemical industrial factories, industrial factories, crematoriums, steelworks, petroleum refineries, gold melting and boiling businesses, rice mills, seaports, natural gas separation plants and diffusive dust from cargo ships.

○ Air quality troubleshooting in critical areas

1. Haze problem in 9 northern provinces

1.1 There was a collaborative integration among relevant organizations led by the Ministry of Interior through the mechanism of the Public Disaster Prevention and Mitigation Act, B.E. 2550 where provincial governors are a commander with a single command method. Following the "4 Spatial measures 4 management measures" guiding principle, the team implemented proactive protocols on prevention, and solutions to solve the haze problem in northern Thailand, in which 4 spatial covers 4 main areas: (1) conserved forest and national reserved forest areas (2) agricultural areas (3) community/city areas, (4) road-side areas. And 4 management measures are: (1) incident command system (2) awareness raising measures (3) fuel reduction measures and (4) volunteer measures on fieldwork activities to learn knowledge management for sustainable haze solutions. After the implementation of haze problem prevention solutions each year, there is an evaluation of the results or After-Action Review (AAR) to analyze areas for improvement and adjustments to next year's implementation plan for greater efficiency.

1.2 There is continuously Transboundary Haze Pollution problem solving in ASEAN via the mechanism of ministerial and senior officials meeting, following the Prime Minister's statement in the ASEAN Summit that ASEAN should be collaborating closely, as well as an intergration of relevant elements to intensively problem - solving regarding transboundary haze pollution, aiming for a Haze-free ASEAN by 2020. The ASEAN Transboundary Haze-Free Roadmap was created and got approval from the 12th Meeting of the Conference of the Parties to the ASEAN Agreement on Transboundary Haze Pollution (COP-12) and the 28th & 29th ASEAN Summits, resulting in collaboration between ASEAN countries in solving transboundary haze pollution to achieve the roadmap goal, as well as a collaboration with neighboring countries for sustainable haze solutions.

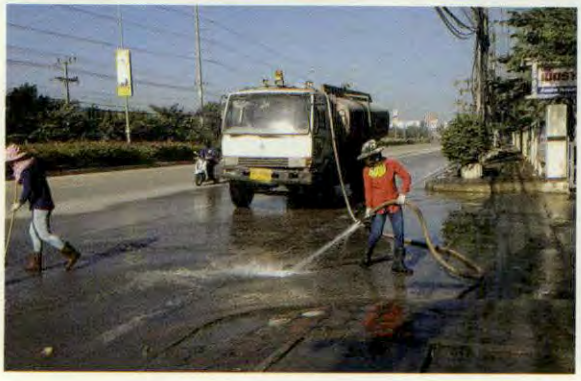
2. PM_{10} in Na Phra Lan SubDistrict, Saraburi province

2.1 Regularly monitor and regulate mining activities and primary industries and mines in Na Phra Lan subdistrict area, Saraburi province. As well as giving recommendations on proper environmental management according to academic principles to prevent and reduce the possible impact of mining activities on the environment and to prevent impact to people living nearby. Moreover, monitoring of the quality of the environment in operating areas and community areas around Na Phra Lan subdistrict area was also implemented.

2.2 Spot check monitoring on dust ventilation from production processes of stone crushing plants and cement plants.

2.3 Held periodic joint meetings between Saraburi provincial administrative organizations and related parties to review haze problem prevention and solution measures.






3. $PM_{2.5}$ in Greater Bangkok

3.1 Set guidelines for prevention and a plan to find a solution to solve the $PM_{2.5}$ problem in Bangkok and vicinity in order to promptly respond to the critical situation as follows.

Step 1 Preparation (November): Organized clarification sessions regarding prevention and a plan to solve the $PM_{2.5}$ problem and integrated all related information predicting the situation, as well as ensured the readiness of all relevant agencies to implement new measures, including pollution controls and reduction from pollution sources.

Step 2 Action (December - March): Monitor and notify on the $PM_{2.5}$ situation through various channels, i.e. the website Air4Thai.pcd.go.th, the Air4Thai application and the Pollution Control Department's Facebook fan page to inform and communicate update air quality state to citizens, and also for the relevant agencies to implement the operation as specified in the measures. The operation method for each situation is classified by the amount of $PM_{2.5}$, which is divided into 4 levels, based on the intensity of the situation:

Level 1: $PM_{2.5}$ is less than 50 $\mu g/m^3$. Every government unit should respond according to their responsibility and regulations to reduce the amount of $PM_{2.5}$.

Level 2: $PM_{2.5}$ is between 50-75 $\mu g/m^3$. Every government unit has to implement all the measures more intensively than in level 1 to reduce the amount of $PM_{2.5}$. The provincial governors of Bangkok and vicinity are the commanders to control the situation in their respective areas.

Level 3: $PM_{2.5}$ is between 75-100 μg/m^3. After following the measures in level 2 and the amount of $PM_{2.5}$ still remains, and steady, not, and decreasing predicted to be higher (from predictions of the Meteorological Department), the measures have to be increased to level 3. The pollution control committee will organize a meeting to find measures that are supported by academic information to control pollution sources. At this level, the Bangkok governor and the 5 provincial governors in vicinity will enforce the law and acts to control, solve and proceed to decrease the amount of $PM_{2.5}$ and remedy impact on local people. For example, using The Public Health Act B.E.2560, Public Disaster Prevention and Mitigation Act, B.E.2550 or other local regulations to control the area or pollution sources that affect people health.

Level 4: $PM_{2.5}$ is over 100 μg/m^3. After increasing measures to level 3 and the amount of $PM_{2.5}$ is not decreasing and continuously tends to be higher than 100 μg/m^3, there will be an urgent meeting of the National Environment board to consider measure to solve the $PM_{2.5}$ problem, which will be submitted to the prime minister to command.

Examples of measures

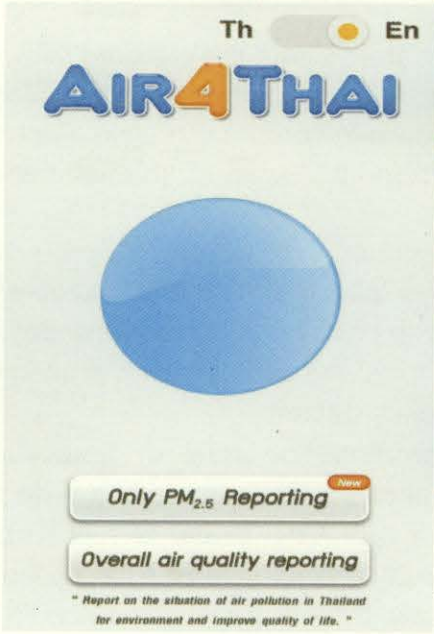
- Prohibiting any open burning in rice fields or other agricultural areas, and in Bangkok and vicinity.
- Increasing the frequency cleaning roads in Bangkok and spraying water to reduce the particulate matter in the areas where $PM_{2.5}$ exceed the standard value.
- Increase black smoke from vehicle inspection checkpoint and strictly enforce the law for small and large vehicles, as well as public vehicles. A prohibition on entering the inner city and parking are included.
- Return the traffic lane in the areas where the elevated railway construction completed as soon as possible. For the areas during under construction, traffic lane should be expanded wider and minimize space in construction areas. Control particulate matters emission from building construction and expend traffic lane and rehabilitate road.
- Create artificial rainfall in Bangkok in crisis case.

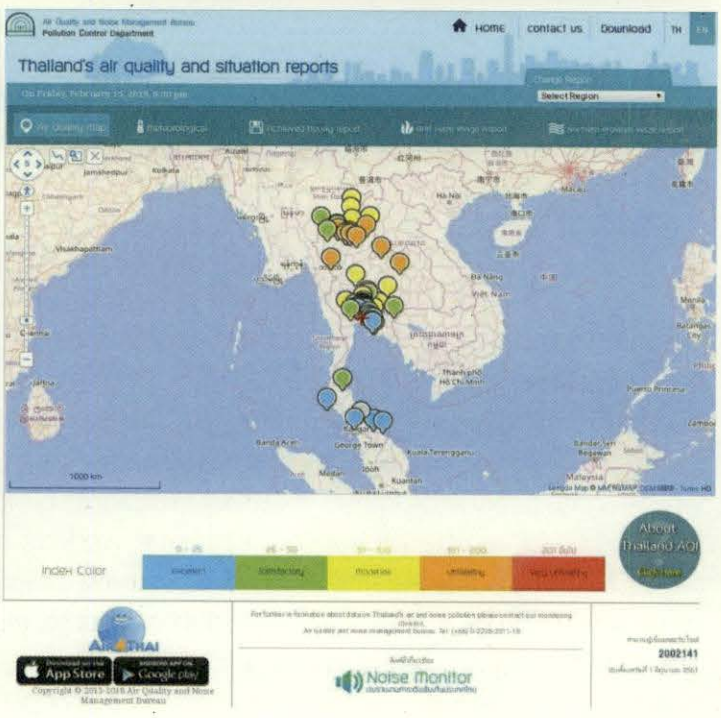
Step 3 Relevant agencies make an action plan to solve the $PM_{2.5}$ problem (in level 2 and 3) and submit to the Bangkok governor to proceed as the commander in the crisis situation. The Pollution Control Department joins and supports with academic information and air quality data from air quality monitoring stations.

3.2 Long-term measures: Change and promote the usage of diesel fuel which contains 20% biodiesel oil (B20) instead of typical diesel oil. Promote and support electric/hybrid vehicle production. Continue working on improving quality of fuel to be aligned with Euro 5 standards. Also, improve new car quality according to Euro 5 and Euro 6 standards. Improve public transportation networks, research the feasibility study on limit the usagelife of vehicles, maintenance vehicles, increase taxes on old vehicles, and set zoning to limit vehicles entering the main city. Improve the monitoring system on the

health impacts and develop disease diagnosis from air pollution.

3.3 Develop the national air quality reporting system for communication information access to Thai citizens and all related parties. Adopt an air pollution warning system with up-to-date information for take care of public health. Currently, there are 43 $PM_{2.5}$ air quality monitoring staion in Bangkok and vicinity and improve air quality index by combine calculateting $PM_{2.5}$ including public through the Air4Thai.pcd.go.th website and Air4Thai application.





4. Volatile Organic Compounds (VOCs) in Map Ta Phut and nearby area, Rayong province

Integrated with relevant agencies to inspect the causes and continuously make measures in order to control, prevent and reduce the emission of VOCs from industrial factories in Map Ta Phut area. Utilize the mechanism of the Eastern Seaboard Development Committee in the process of planning and monitoring environmental problems in the area, including monitor the VOCs situation in the area. If VOCs has found exceed than 24-hours surveillance value, the responsible agency will be notified to search for the pollution source and strictly control the problem. Moreover, create VOCs emission measures to control factories with high volume usage of VOCs.

State of solid waste and hazardous waste, and Solid waste and hazardous waste management

State of solid waste and hazardous waste

There was a higher amount of municipal solid waste generated in 2018, but solid waste management, waste separation and proper disposal have continued to improve in an upward trend.

The amount of municipal solid waste generated in 2018 was at 27.8 million tons, which is a 1.64% increase from 2017 due to expanding urban communities, and lifestyle changing from the shift of an agricultural to an urban society. Moreover, population growth, promoting tourism and higher consumption are also factors that cause higher amounts of solid waste in various areas.

However, though the amount of solid waste is higher compared with last year, solid waste management in 2018 also showed improvement. More municipal solid waste (9.58 million tons or 34%) was separated at its sources and re-utilized, which was a 13% increase from 2017. Most of the re-utilization is for recycling and natural fertilizer making purposes. For the remainder of the municipal solid waste, 10.88 million tons (39%) was disposed appropriately, while another 7.36 million tons (27%) was still disposed improperly. The improvement of waste management resulted from government policy concerning Zero Waste Society, which is based on the 3R approach - civil state focus on waste management at the source by the collaboration of both public and private sectors. (Figure 15)

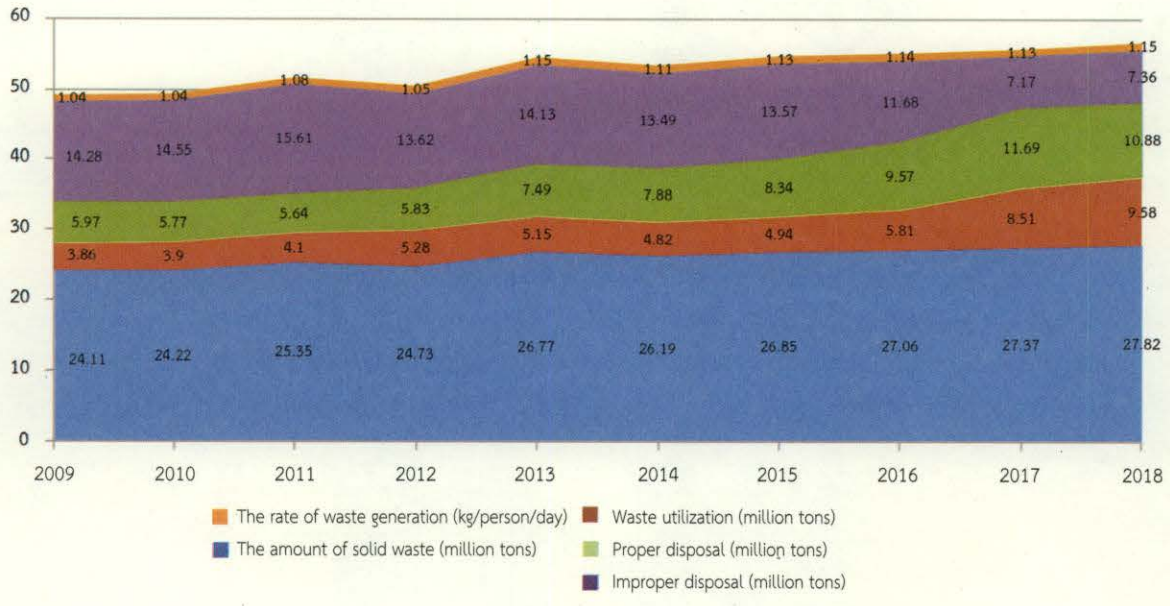


Figure 15 The proportion of solid waste generated, re-utilized, disposed appropriately and disposed inappropriately, 2009 – 2018

The collection of solid waste for disposal by local administrative organizations in many areas are still managed inappropriately

4.85 million tons of solid waste was generated in Bangkok (17% of total solid waste in the country), and 0.92 million tons (19% of solid waste in Bangkok) were segregated and recycled. The remaining 3.93 million tons were disposed properly, practices of sanitary landfilling, in the Phanom Sarakham district, Chachoengsao province and the Kamphaeng Saen district, Nakhon Pathom province, and through burning in incinerators at the solid waste collecting center in Nhong Khaem, Bangkok. For the other 76 provinces, 22.97 million tons of solid waste was generated (83% of total solid waste in the country). This waste was collected by local administrative organizations that have a solid waste management system and delivered to 4,894 solid waste disposal centers countrywide. In the meantime, there are 2,881 local administrative organizations which did not have a solid waste management system. People in such districts need to dispose their waste in their own areas.

In 2018, there were 3,205 solid waste disposal and transfer sites, with 2,786 sites still in operation and another 419 sites which have been closed by local provincial policy due to being full and to promote regional collaboration on waste management. Regarding the disposal sites which have been shut down, 371 of them are managed by the public sector, with most of them being solid waste disposal centers at the village and community level, as well as disposal sites which were deemed to have inappropriate operation (table 3). However, the utilization of solid waste as fuel for electric generation in power plants is an alternative method of supporting local administrative organizations on their management of solid waste. Currently, there are 35 electric power plants that use waste as their fuel, with a capacity of 313.354 megawatts altogether, where they produce electricity generated from waste and sell it commercially.

Table 3 Status of municipal solid waste disposal and transfer sites, in 2018

Total of 3,205 municipal solid waste disposal and transfer sites			
2,786 in operation		419 are closed	
Public sites	Private sites	Public sites	Private sites
2,398	388	371	48
Total of 2,764 munucipal solid waste disposal and total of 22 transfer sites Total of 647 proper munucipal solid waste disposal and transfer sites			

Type	Number (site)	
	Public	Private
Sanitary landfills/ Engineered landfills/ Semi-Aerobic landfills	90	19
Controlled dumps with a capacity of less than 50 tons/day	386	87
Incinerators with air pollution control system	16	11
Incinerators for energy production	0	6
Compost System	6	3
Mechanical-biological treatment system/ Refuse derived fuel production	18	5
Total	516	131

Most of the marine debris in the sea is both plastic waste from inland waste and solid waste that is directly throw away into the sea.

27.8 million tons of solid waste produced in 2018, 2 million tons is municipal plastic waste. Around 500,000 tons of solid waste can be used in recycling systems (most of it is plastic bottles) and the other 1.5 million tons is plastic waste, which consists of 1.2 million tons of plastic bags, and the rest being other plastic garbage, such as glass, boxes, trays, bottles, bottle with lids. In 2018, there was 7.15 million tons of solid waste that was disposed inappropriately, such as by open dump or open burning in waste disposal sites, illegal dumping in public areas and throw away into water sources. These activities result in the contamination of inland wastes into the sea, including solid waste directly throw away into the sea, plastic waste in the sea causes a negative impact to marine animals, as seen in news reports about a short-fined pilot whale found beached and dead on May 28, 2018, in the Klong Na Tub, Songkla province. Scientists determined the cause of the whale's death was a gastric obstruction due to eating plastic wastes.

From the activities residual wastes collection at beaches, coral reef and mangrove forests in 48 areas covering 24 provinces, 569,657 pieces of residual wastes was collected, with a weight of 33 tons. The top 10 residual wastes were: miscellaneous plastic bags (18.9%), plastic beverage bottles (8.6%), thin plastic shopping bags (8.4%), foam dishes and bowls (6.9%), glass beverage bottles (6.6%), food/snack packages, such as confectionaries, chips, etc. (6.1%), straw and swizzle sticks (4.6%), foam scraps (4.4%), foam meal boxes (3.8%) and plastic cups (3.6%).The remaining 28.1% consisted of other wastes.

Municipal hazardous waste management has improved, but the launch of regulation needs to be accelerated

The volume of municipal hazardous wastes generated in 2018 is 638,000 tones, 3.2% increase from 2017. 65% of this hazardous wastes (414,600 tons) was Waste Electrical and Electronic Equipment (WEEE) and the other 35% (223,400 tons) was other municipal hazardous waste, such as batteries, dry cell batteries, chemical containers and spray bottles. A municipal hazardous waste management system has been installed by having local administrative organization and relevant agencies collect hazardous waste from villages or communities, and then transfer them to provincial hazardous waste collection centers. The system allows hazardous waste to be managed and treated with proper methodology, and has resulted in a 13% improvement, which is equal to about 83,600 tons. However, the result is still deficient, since there is no regulation to separate hazardous waste from general solid waste, as well as regulations that would enforce the private sector to be responsible for WEEE management. In 2018, the draft of Waste Electrical and Electronic Equipment Management Act (B.E.....) has been approved by the Council of Ministers on December 25, 2018.

Moreover, in 2018, massive illegal importing of electronic and plastic scraps/waste from overseas were found and caught at various customhouse. Illegal littering of such scraps/waste was also found in multiple areas of the country.

The amount of industrial waste tends to be lower and is being improved by a proper managing system which has the potential to serve all industrial waste countrywide

The amount of industrial waste that is pulled into the managing system is 22.02 million tons, decrease of 33% compared to 2017, when 32.95 million tons of industrial waste was pulled into the system. The total amount included 20.82 million tons of non-hazardous industrial waste, of which 7.2 million tons were used as fuel to generate electric power, and 1.2 million tons were hazardous industrial waste.

There is the distribution of industrial waste treatment and disposal factories in each region of the country. The highest treatment and disposal capacity is in the eastern region of Thailand, followed by the central, western, northeastern, southern and northern regions, respectively (Figure 16). However, there are still a number of small and medium enterprises (SMEs) with deficient understanding to operate within the law. A lack of employees responsible for industrial waste management and the high cost of transferring the waste to the disposal/ treatment factory. Therefore, to solve this problem, a project has been launched for each of the 76 provinces in Thailand to establish support centers for business owners to consult and get information related to managing their industrial waste systematically and in line with the law.

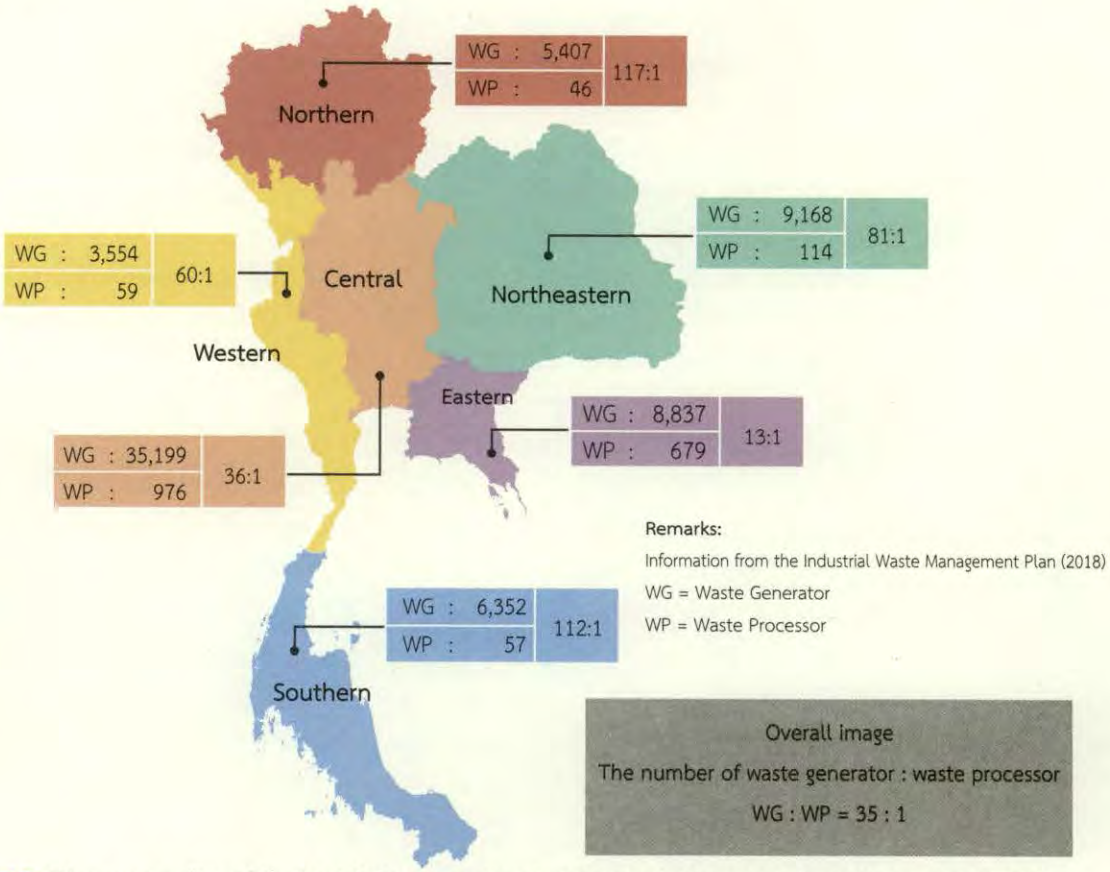


Figure 16 The capacity of industrial waste treatment and disposal factories distribution, and the distribution in each region.

Source : Department of Industrial Works, 2018

Infectious waste management in large infirmaries has been improved but managing system from private medical clinics, veterinary clinics and pet hospitals still needs to be implemented

The amount of infectious waste in 2018 decreased from 57,954 tons in 2017 to 55,497.22 tons (4.2% decrease). Most of the infection waste was generated from public hospitals, private hospitals, private clinics, veterinary clinics and hazardous pathogen laboratories included more than 38,235 locations. 50% of the infectious waste was from public hospitals under the Ministry of Public Health and 24% was from private hospitals and clinics. The amount of infectious waste which was treated properly included 49,897.86 tons (89.91%), with most of the waste being disposed by infectious waste incinerators and autoclaving at the infirmaries. For small clinics, infectious waste was collected and transferred to a host hospital which acts as a center or hub for the network. Currently, private clinics, veterinary clinics and pet hospitals do not have a report system for infectious waste management state. (Figure 17)

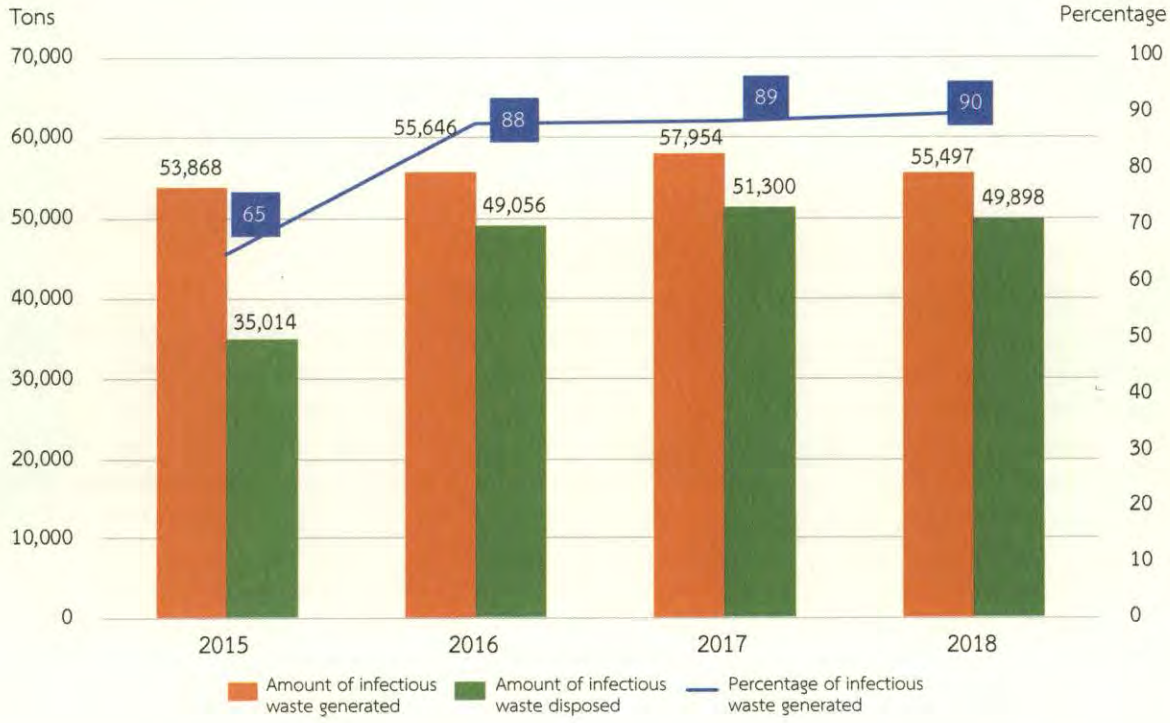


Figure 17 The amount of infectious waste generated and disposed in 2015-2018

Source: Department of Health, 2018

Solid waste and hazardous waste management

Set up the solid waste and hazardous waste management plan

Create a 20-years master plan regarding prevention and management for pollution caused by solid and hazardous waste (2018 – 2037) with the framework integrated between 3R, Circular Economy/waste to resources, Polluter Pays Principle (PPP). Encourage the private sector to participate in joint investment (Public Private Partnership) on waste management. Draw producers to participate in waste management activities by adopting the Extended Producer Responsibility (EPR) approach, covering 4 types of waste (municipal solid waste, municipal hazardous waste, infectious waste and industrial waste), and by supporting and encouraging eco-friendly product and package designs (Design for Environment: DfE). Control, limit and ban the usage of single use plastic products. Rehabilitate and improve waste disposal sites to operate properly based on academic guidance. Encourage local administrative organizations regarding confederation of neighborhood areas (clustering) for joint solid waste management. Launch a regulation for Waste Electrical and Electronic Equipment management, and strictly control the import of electronic and plastic scrap. Study the impact of pollution caused by technological waste or emerging waste. Also, create regulations on waste management in terms of general regulations covering all kinds of waste.

Municipal solid waste management

1. Promote waste reduction and separation from sources

1.1 Promote a campaign to create awareness, understanding and the mindset to participate in waste reduction and separation for recycling purposes, as well as solid waste management at source.

1.2 The cabinet resolution, on July 17, 2018, approved the project "Tum Kwam Dee Duay Hua Jai, Lhod Phai Sing Waed Lom" (Do the good activities with heart, reduce danger to environment). This project will include national park and zoo areas, public sectors acting as a role model, and encouragement of the private sector and public to reduce and separate solid waste, as well as reducing the use of plastic bags for both givers and receivers, and giving up the use of foam meal boxes. Inland waste to marine debris management in 24 seaside provinces is also included.

1.3 Private sector to participate in the promotion of waste reduction, such as launching the campaign of no plastic bag-free day in leading shopping department stores convenience stores.

2. Encourage, support and giving recommendations to local administrative organizations on clustering for centralized solid waste management

Starting with reduction and separation since a household level, collection/ transfer by type of wastes and disposal of each types by appropriate methods. Provide recommendations on building solid waste disposal sites, as well as maintenance and improvement/rehabilitation the sites in appropriate practices.

3. Follow-up, monitor and provide recommendations to solid waste disposal sites of local administrative organization that are facing problems and recommend possible solutions for improvement sites.

4. Launch guidelines and criteria regarding solid waste management for local administrative organization and relevant agencies to use as a guideline to create an appropriate solid waste disposal sites for each local administrative organization conditions.

4.1 Criteria for appropriate consideration of the area to build a solid waste disposal sites, design and construction, as well as operational management methods that are aligned with proper approaches to sanitary landfill sites, incineration sites, fertilizer-from-waste creation sites and solid waste transfer sites.

4.2 Criteria/standards for municipal solid waste separation and waste-to-fuel transformation sites designs and construction.

4.3 Criteria for consideration in the adoption of proper solid waste management technology that best matching with the local administrative organization.

4.4 Guidelines on effective solid waste disposal by incinerator.

4.5 Primary proper qualification of waste fuel from municipal solid waste.

5. Plastic waste management

Focus on inland waste management, especially single-use plastics and plastic scraps imported for being ingredients in industrial factories after being recycled.

5.1 Draft a plastic waste management roadmap (2019-2027), aiming to

(1) Draw all plastic product and packaging waste into recycling systems for 100% re-utilization by 2027.

(2) Reduce or stop using plastic products and packaging, or shift to alternative eco-friendly material for seven types of products/packaging

(a) Stop using cap seals by 2019

(b) Stop using oxo-contained plastic products by 2019

(c) Stop using plastic microbeads by 2019

(d) Stop using plastic shopping bags with < 36-micron thickness by 2022

(e) Stop using foam meal boxes by 2022

(f) Stop using single-use plastic cups with <300-micron thickness by 2022

(g) Stop using plastic straws by 2022

5.2 Control the import of plastic scraps

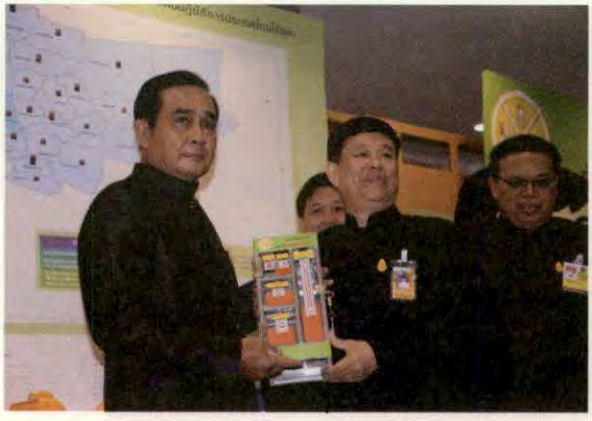
(1) Stop the import of plastic scraps from overseas within 2 years (2019-2020) to promote the use of domestic plastic scraps

(2) Increase strictness in law enforcement, as well as monitoring and controlling import routes

6. Marine debris management reduce the amount of solid waste throw away into sea from target groups, which include commercial fishing boats, local fishing boats, coastal communities and tourism companies and tourists. In 2018, the policy implementation in several locations in 10 different areas within seashore provinces; 1) Coastal communities: Saengchan beach, Nern-Phra subdistrict, Mueng district, Rayong province 2) Commercial fishing boats: Samut Prakan Fishery Association, Samut Prakan province 3) Local fishing boats: Tajeen river and Mae klong river estuary, Samut Songkram province 4) Tourism companies: Chao Samran Beach, Mueng district, Petchburi province 5) Coastal community: Ban Laen Pho community market, Pumriang subdistrict, Chaiya district, Suratthani province 6) Coastal community: Moo 1, Baan Aow Sai, Koh Yor subdistrict, Mueng district, Songkla province 7) Local fishing boats: Local fishing boats wharf, Pa Na Re subdistrict, Pa Na Re district, Pattani province 8) Coastal community: Koh Kai, Pru nai subdistrict, Koh yaw district, Pang Nga province 9) Tourism company: Koh He, Ra Wai subdistrict, Mueng district, Phuket province 10) Coastal community: Mook island Koh Libong subdistrict, Kan Tang district, Trang province

Municipal hazardous waste management

1. Install a municipal hazardous waste management system with local administrative organizations and relevant agencies to provide the waste collection points and then transfer the waste to provincial hazardous waste collection sites, as well as accelerate a launch of regulations aiming for separation of municipal hazardous waste from other general waste, for both creation and enforcement.



2. Create a draft of the Waste Electrical and Electronic Equipment Management Act, and specify product producers to be responsible for the disposal of its product scrap after consumption, following the Extended Producer Responsibility (EPR) approach with the system or mechanism to retrieve product scraps and properly dispose further, in order to reduce the impact on environment and public health. Currently, the drafted act is approved by the council of ministries on December 25, 2018.

3. Control and proceed on waste from electrical and electric equipment separation locations which operate illegally. A case study from Kong Chai district, Kalasin province, is a collaboration between the public sector and enterprises by expeditiously removing electric waste from the waste disposal pond and then proceeding with the appropriate disposal method based on academic approaches, together with the cultivation of plants which are able to absorb the toxicity from soil and water sources to restore the area after possible pollution problems. A measure to stop and prevent the mixing of the disposal of hazardous waste or electronic waste with municipal solid waste is also specified.

4. Set a measure to cancel and prohibit the import of electronic waste from overseas within a period of less than 2 years (2019-2020). Cancellation the import of used electric and electronic equipment, except for necessary purposes. Strict import investigation measures should be set and intensively implemented. Increase strictness in law enforcement, as well as ensure compliance with the law by closely monitoring import routes and overseeing business operations of separation and recycling factories.

Industrial waste management

1. Provide consultation to the enterprises on systematic alignment with laws on industrial waste management. Support officers operations on law enforcement and control of industrial factories that still unsystematic management and do not comply with the law.

2. Improve capacity and potential to re-utilize industrial waste to promote recycling and reduction of disposal waste.

3. Improve and develop information technology systems of industrial waste management to service user who are involved with industrial waste, as well as support the monitoring of relevant agencies.

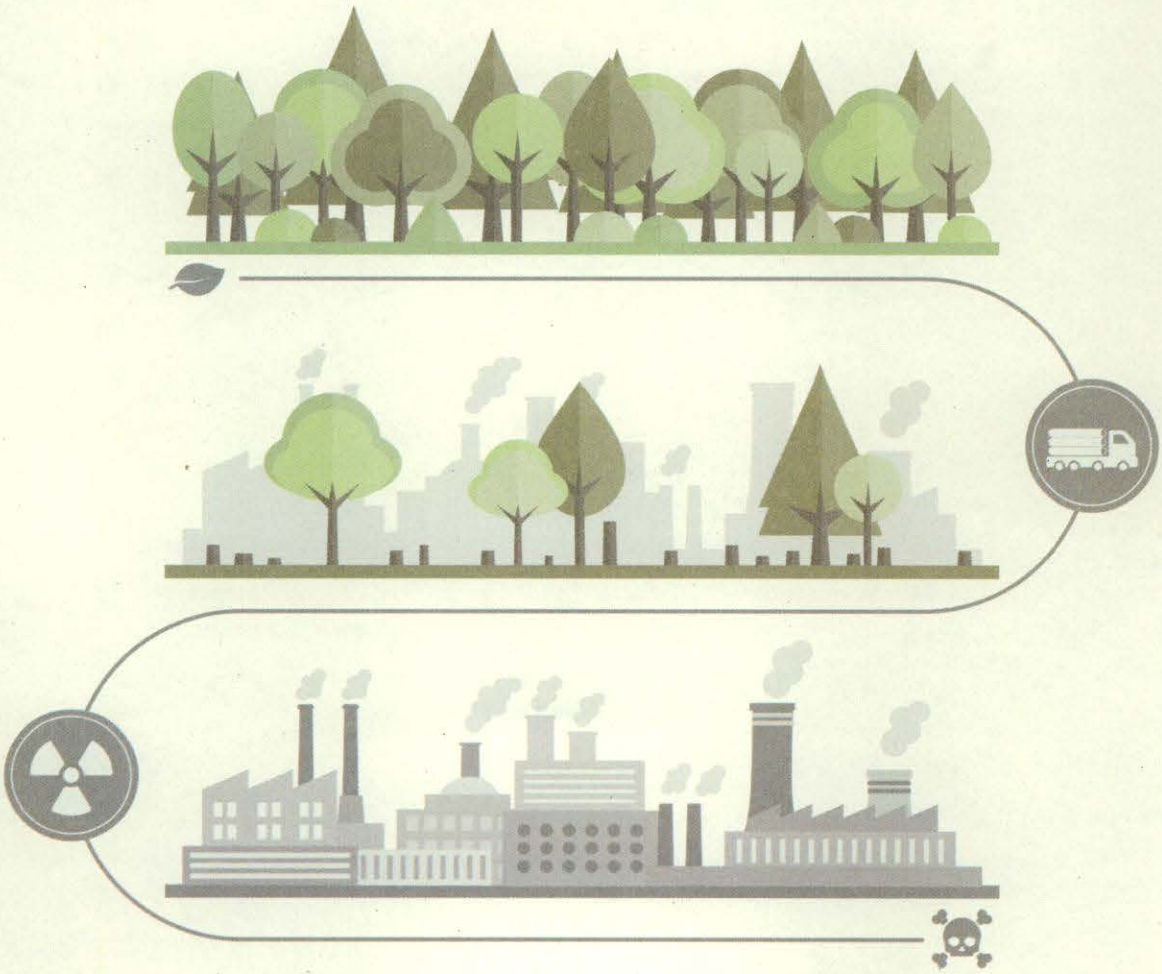
4. Support and follow-up on license extension of factories with a lack of industrial waste management countrywide.

Infectious waste management

1. Create and manifest an online data record system about infectious waste and install GPS tracking on infectious waste transport vehicles from hospitals to control the logistic and systemic disposal of infectious waste.

2. Improve environmental hygiene and management of all types of waste in hospitals and public health centers based on a sustainable and ecological sanitation approach under the "Green and Clean hospitals project", in order to encourage hospitals support the health of people and officers and to be environmentaly friendly.

3. Promote and encourage central management of infectious waste. Increase capability of public health officers for both provincial and hospital levels on monitoring and appropriate management of infectious waste, including infectious waste generated by patient treatment, and the efficient operation of the collection and transfer system.



Environmentally Friendly Products and Services

6 service types

- Photocopier rental
- Cleaning service
- Hotel service
- Petrol station
- Car service station (Lubricant Change)
- Garage

24 product types

- Ink cartridge
- Photocopier
- Car
- Photocopy and printing Paper
- Metal furniture
- Petrol
- Paper folder
- Computer
- Lubricant oil
- Document envelope
- Uninterruptible power supply (UPS)
- Van
- Document storage box
- Toilet paper
- Tire
- Correction pen and tape
- White board marker
- Car battery
- Fluorescent lamp
- Primary battery
- Cool mode fabric products
- Paint
- Printer
- LED Lamp

Others

- Products that are registered for Carbon Footprint Reduction

Information and database for environmentally friendly products and services
Website http://gp.pcd.go.th and Mobile Application: Thai GPP

Mobile App Version

Thai GPP

Google Play Apple Store

Booklet on Thailand State of Pollution 2018

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