

PM 2.5 and health

Ambient air particulate matter 2.5 (PM_{2.5})

- อุนุภาคขนาดจิ๋ว เส้นผ่าศูนย์กลาง น้อยกว่า 2.5 ไมครอน ใน บรรยากาศ
- สามารถเข้าสู่กระแสเลือดปอด และ ไปตามกระแสเลือดได้
- เกิดการอักเสบไปทั่วไปทั่วร่างกาย มีลิมเลือดอุดตัน และ เชลล์เยื่อ บุผิวเส้นเลือดเสียหาย
- การอักเสบมีผลต่อระบบอัตโนมัติ ในร่างกาย

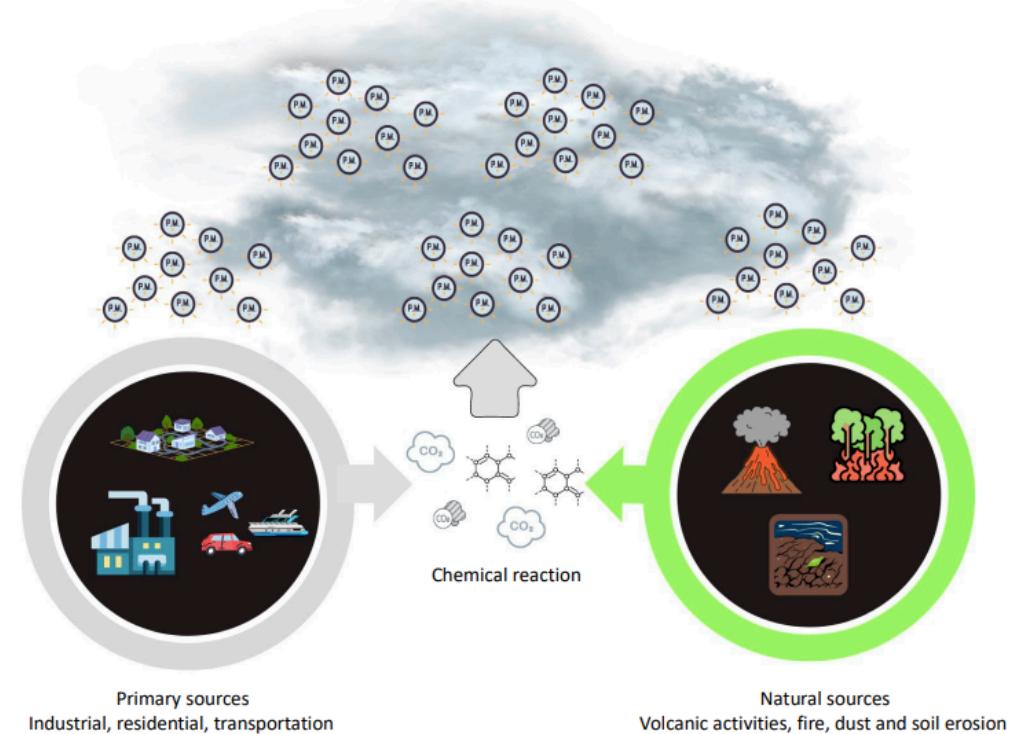
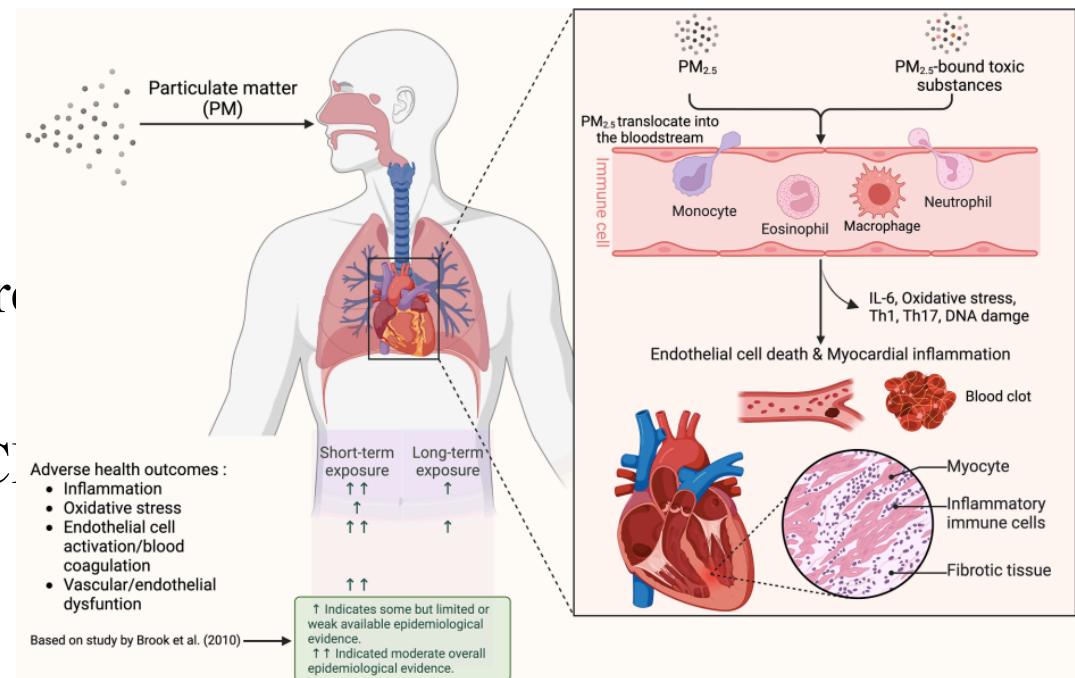


Figure 2. Emissions source of PM_{2.5}.

ผลกระทบกับร่างกาย

- เพิ่ม blood pressure
- เพิ่มความเสี่ยง myocardial infarction
- เพิ่มความเสี่ยง stroke
- เพิ่มความเสี่ยง arrhythmia และ CHF
- เพิ่มการเกิด DM และ DLP
- asthma/COPD อาการแย่ลง
- เพิ่มการเกิด pulmonary fibrosis
- เพิ่มการติดเชื้อในปอด
- เพิ่ม cognitive impairment, Alzheimer, Parkinson



Environmental Advances 18 (2024)
100603 Epigenomes 2024, 8, 13

International Journal of Cardiology Cardiovascular Risk and Prevention 19 (2023)

Acute effects of air pollutants on daily mortality and hospitalizations due to cardiovascular and respiratory diseases

Chaicharn Pothirat, Warawut Chaiwong, Chalerm Liwsrisakun, Chaiwat Bumroongkit, Athavudh Deesomchok, Theerakorn Theerakittikul, Atikun Limsukon, Patraporn Tajarernmuang, Nittaya Phetsuk

- PM2.5 was found to be associated with increased daily mortality of hospitalized patients (lag day 6, adjusted RR =1.153, 95% CI: 1.001–1.329)
- PM2.5 was associated with acute exacerbation of chronic obstructive pulmonary disease (AECOPD)
- Conclusions: Seasonal air pollutants were found to be associated with higher mortality among hospitalized patients and community dwellers with varying effects on severe acute respiratory, cardiovascular, and cerebrovascular diseases

The short-term associations of particular matters on non-accidental mortality and causes of death in Chiang Mai, Thailand: a time series analysis study between 2016-2018

Chaicharn Pothirat , Warawut Chaiwong , Chalerm Liwsrisakun ,
Chaiwat Bumroongkit, Athavudh Deesomchok, Theerakorn Theerakittikul,
Atikun Limsukon, Pattraporn Tajarernmuang and Nittaya Phetsuk

ABSTRACT

Open burnings, agricultural and forest fires, are the major sources of particulate matters (PM) in Chiang Mai during dry season. We aim to determine the association of an increased daily PM (PM_{10} , $PM_{2.5}$) and daily non-accidental mortality and causes of death in Chiang Mai. The association between PM and daily non-accidental mortality including causes of death were analyzed using a generalized linear model with Poisson distribution. The results showed that PM_{10} and $PM_{2.5}$ were associated with daily non-accidental mortality on different lag days (adjusted RR range from 1.009–1.018 and 1.016 for each $10 \mu\text{g}/\text{m}^3$ increment of PM_{10} and $PM_{2.5}$, respectively). The causes of death associated with PM_{10} , $PM_{2.5}$ found on different lag days were chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), and sepsis. We concluded that PM_{10} and $PM_{2.5}$ are associated with daily non-accidental mortality and causes of death were COPD, CAD, and sepsis.

- PM2.5 was associated with daily non-accidental mortality (adjusted RR 1.016 for each $10 \mu\text{g}/\text{m}^3$ increment of PM2.5)
- causes of death were COPD, CAD, and sepsis.

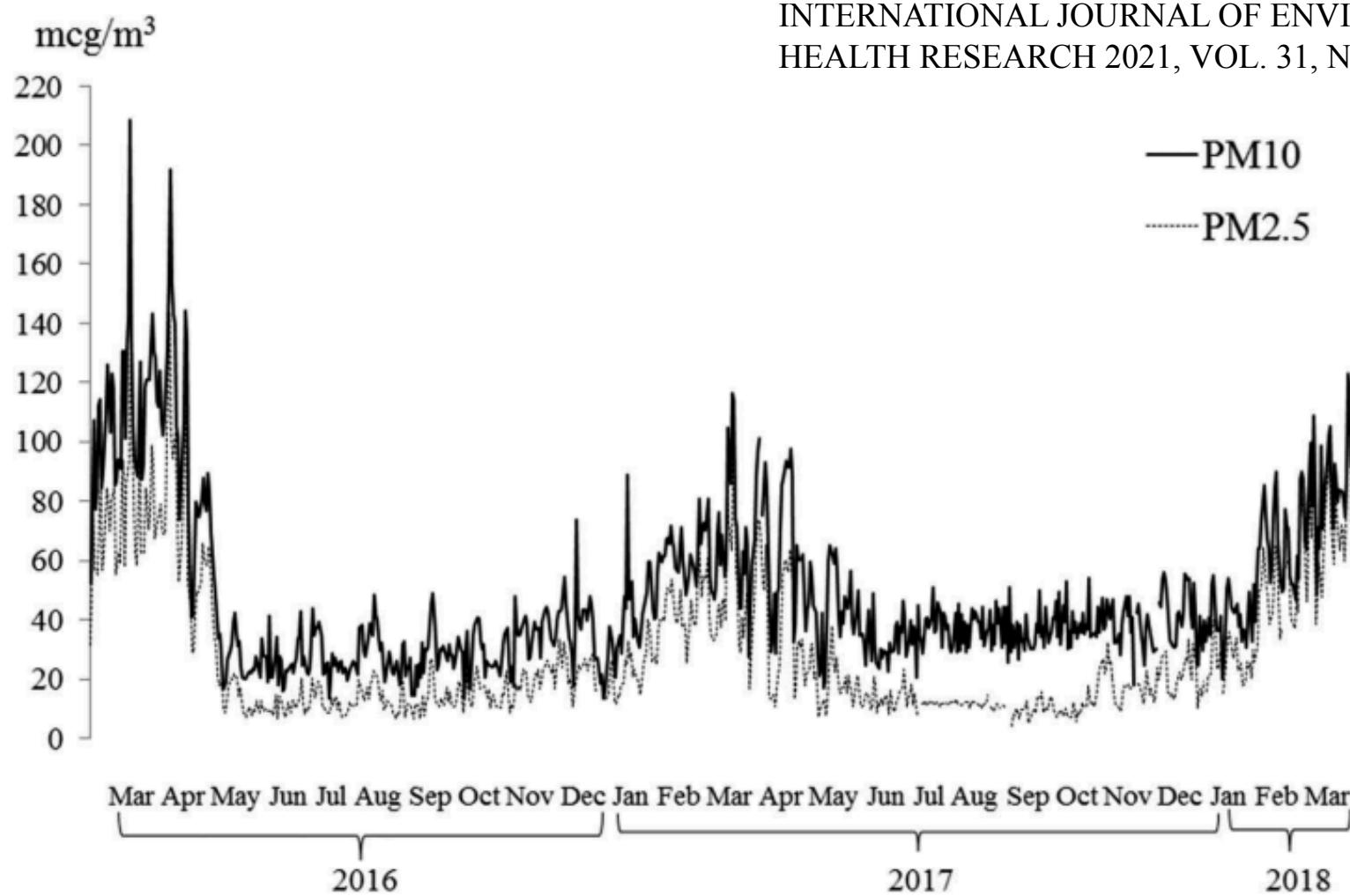


Figure 2. Variation of PM₁₀ and PM_{2.5} throughout the study period (March 2016 – March 2018).

Abbreviations: PM₁₀, particulate matters with diameter of less than 10 micron; PM_{2.5}, particulate matters with diameter of less than 2.5 micron

Table 2. Descriptive summary of non-accidental mortality and disease-specific death during study period (March 2016 – March 2018).

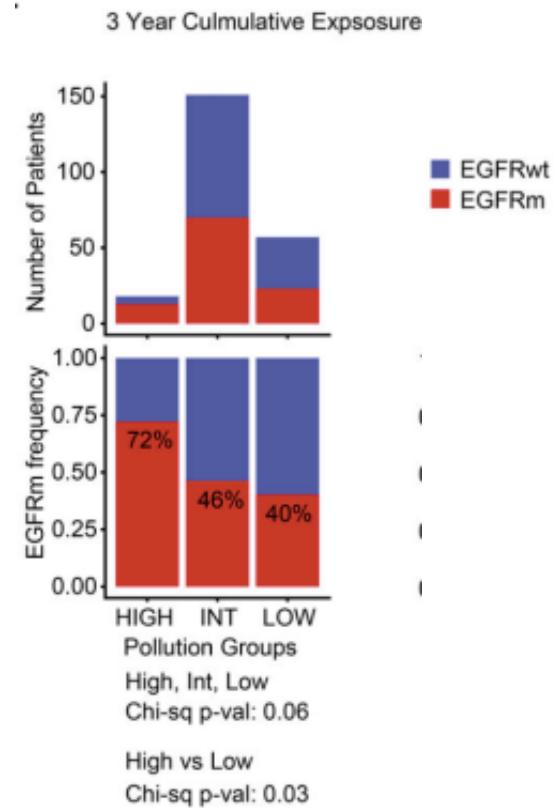
Demographic data	Mean \pm SD
Age	69.28 \pm 16.14
Male gender	14,809 (56.6%)
Age group	
18-39	1,345 (5.1)
40-59	5,686 (21.7)
≥ 60	19,138 (73.2)
Diagnosis of death	
COPD	804
Asthma	235
CAP	1,474
CAD	908
Heart failure	1,600
Stroke	2,422
Sepsis	2,130
Total non-accidental dead	26,169
	Daily (range)
	0 – 5
	0 – 3
	0 – 10
	0 – 5
	0 – 8
	0 – 10
	0 – 11
	15 – 59

Abbreviations: COPD, chronic obstructive pulmonary disease; CAP, community acquired pneumonia; CAD, coronary artery disease

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HEALTH RESEARCH 2021, VOL. 31, NO. 5, 538–547

Lung adenocarcinoma promotion by air pollutants

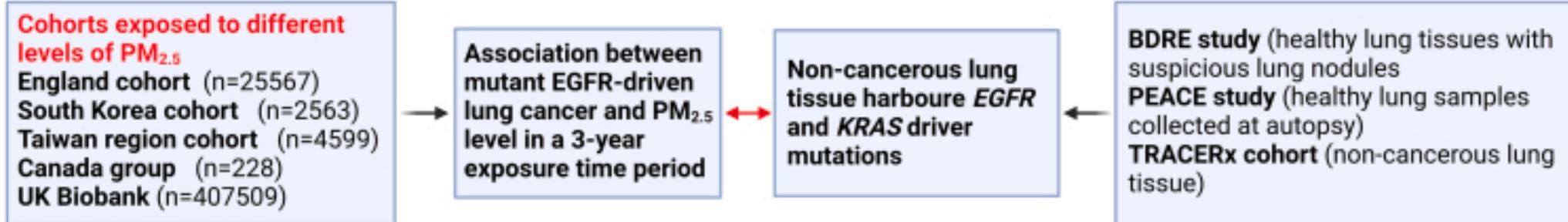
- Lung cancer in never-smokers (LCINS)
 - LCINS frequently harbour adenocarcinomas with oncogenic EGFR mutations
 - more commonly observed in East Asian female individuals
- found a significant **association between PM2.5 levels and the incidence of lung cancer for 32,957 EGFR driven lung cancer cases** in four within-country cohorts.



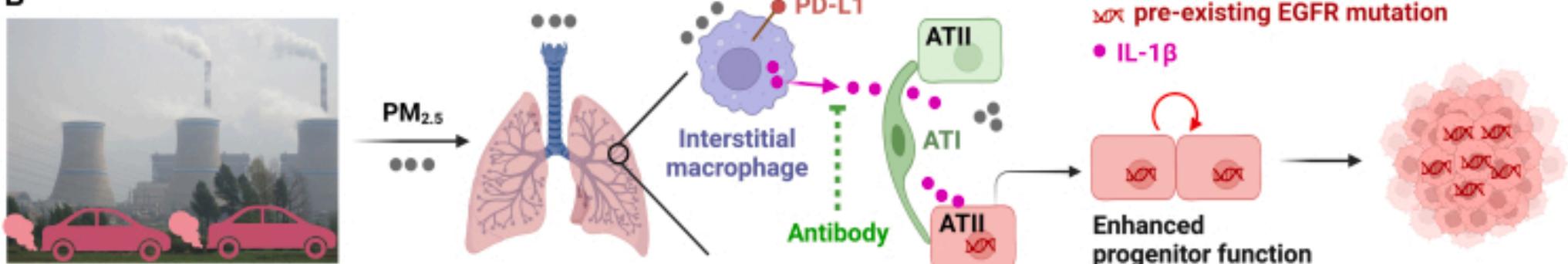
Nature. 2023 April 01; 616(7955): 159–167.

Air pollution, EGFR mutation, and cancer initiation

A



B



Cell Reports Medicine 4, 101046, May 16,

Prevalence of EGFR mutation in non-small cell lung cancer in Thailand

- The EGFR mutation rate was 46.55%, with 108 cases detected out of 232 patients. EGFR mutation was detected in 63.41% of the never smoking group
- non-smoker and adenocarcinoma lung cancer type as significant independent predictors of EGFR mutation detection

Table 3: Estimates for the relationship between a 10-ug/m³ change in PM2.5 exposure and lung cancer incidence

Exposure	RR(95%CI)	I ² (P-Value)	Studies included (by ID)
Incidence	1.07(1.03,1.12)	39.2%(0.118)	6,7,8,9,10,13,16,17
Continent			
North America	1.06(1.01,1.11)	0.0%(0.410)	6,7,8,9
Europe	1.03(0.61,1.75)	78.3%(0.032)	10,13
Asia	1.09(1.03,1.15)	53.1%(0.144)	16,17
Country			
Developed Country	1.07(0.96,1.20)	43.0%(0.118)	6,7,8,9,10,13
Developing Country	1.07(1.06,1.09)	—	17
Gender			
Male	1.23(0.83,1.81)	73.5%(0.052)	6,17
Female	1.15(1.12,1.18)	0.0%(0.917)	6,17
Smoking Status			
Never	1.10(0.76,1.59)	0.0%(0.733)	6,7
Former	1.19(0.95,1.50)	22.7%(0.255)	6,7
Current	1.03(0.87,1.21)	0.0%(0.550)	6,7

Oncotarget, 2017, Vol. 8, (No. 26), pp: 43322-43331

WHO guideline

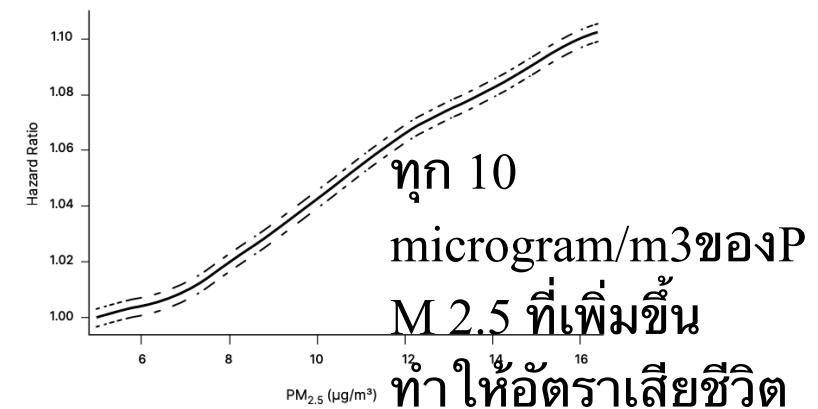
- PM2.5 and all non-accidental mortality; a meta-analytic effect estimate of RR of 1.08 per 10 $\mu\text{g}/\text{m}^3$ PM2.5
- HR of 1.11 for circulatory mortality, 1.10 for non-malignant respiratory mortality and 1.12 for lung cancer mortality.
- support a long-term AQG level of no more than 5 $\mu\text{g}/\text{m}^3$

Table 3.1. Recommended annual AQG level and interim targets for PM_{2.5}

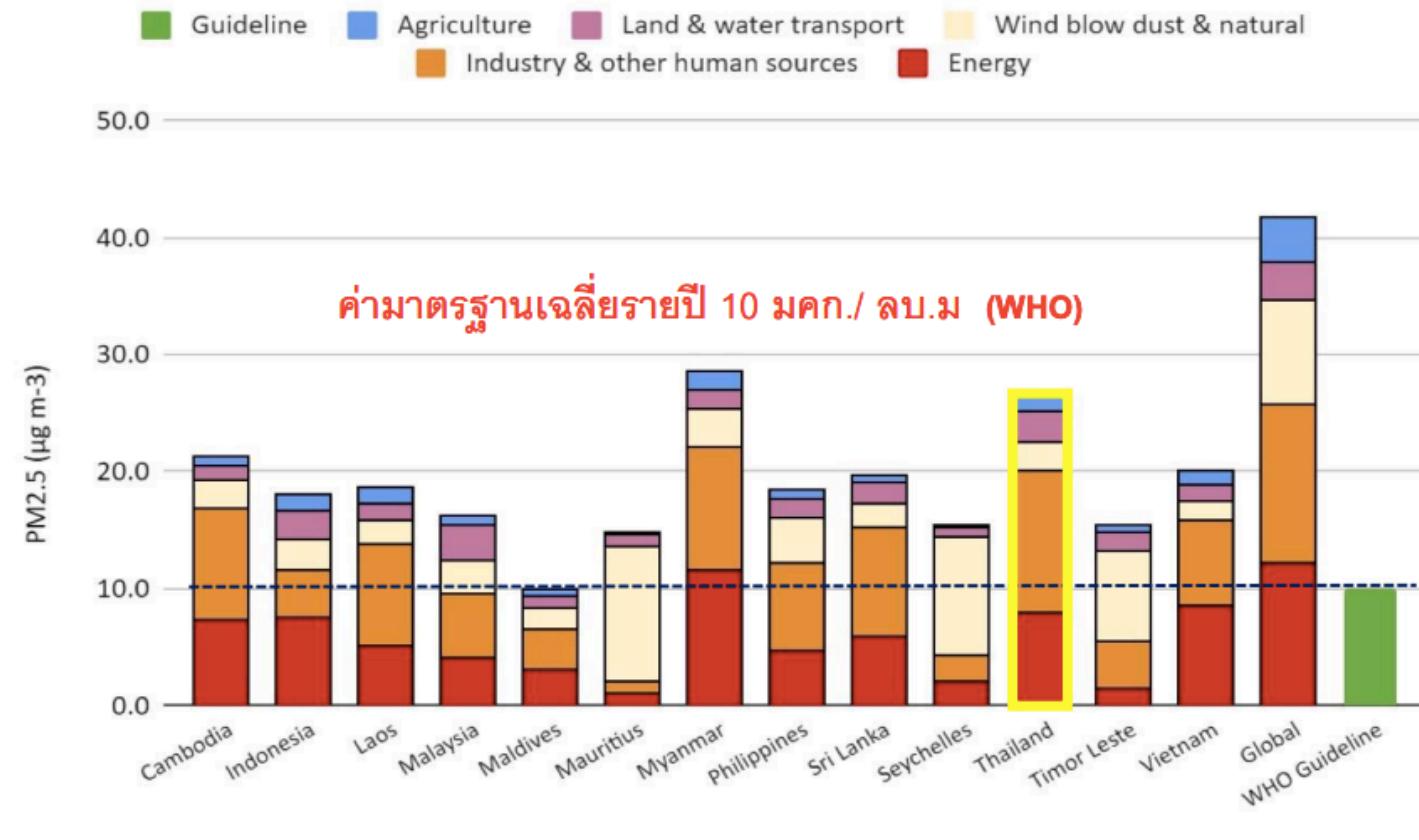
Recommendation	PM _{2.5} ($\mu\text{g}/\text{m}^3$)
Interim target 1	35
Interim target 2	25
Interim target 3	15
Interim target 4	10
AQG level	5

WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide.

Fig. 3.4. CRF for long-term PM_{2.5} exposure ($\mu\text{g}/\text{m}^3$) and all non-accidental mortality



การสัมผัส PM_{2.5} เฉลี่ยรายปี (เฉลี่ยด้วยจำนวนประชากร) แบ่งตามกิจกรรมที่ ในภูมิภาคเอเชียตะวันออกเฉียงใต้ ปี 2562



WHO global air quality guidelines. Particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide.

24 hr. average AQG target

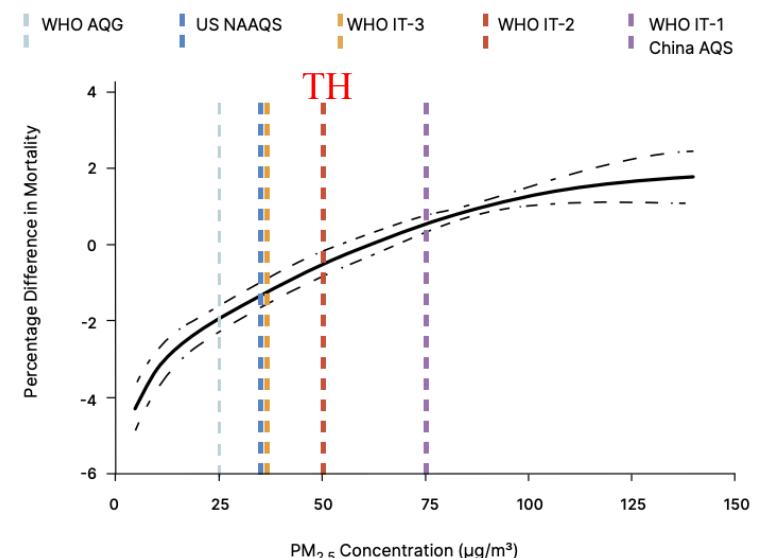
- The recommendation is a short-term (24-hour) PM_{2.5} AQG level of 15 µg/m³

Table 3.6. Recommended short-term (24-hour) AQG level and interim targets for PM_{2.5}^a

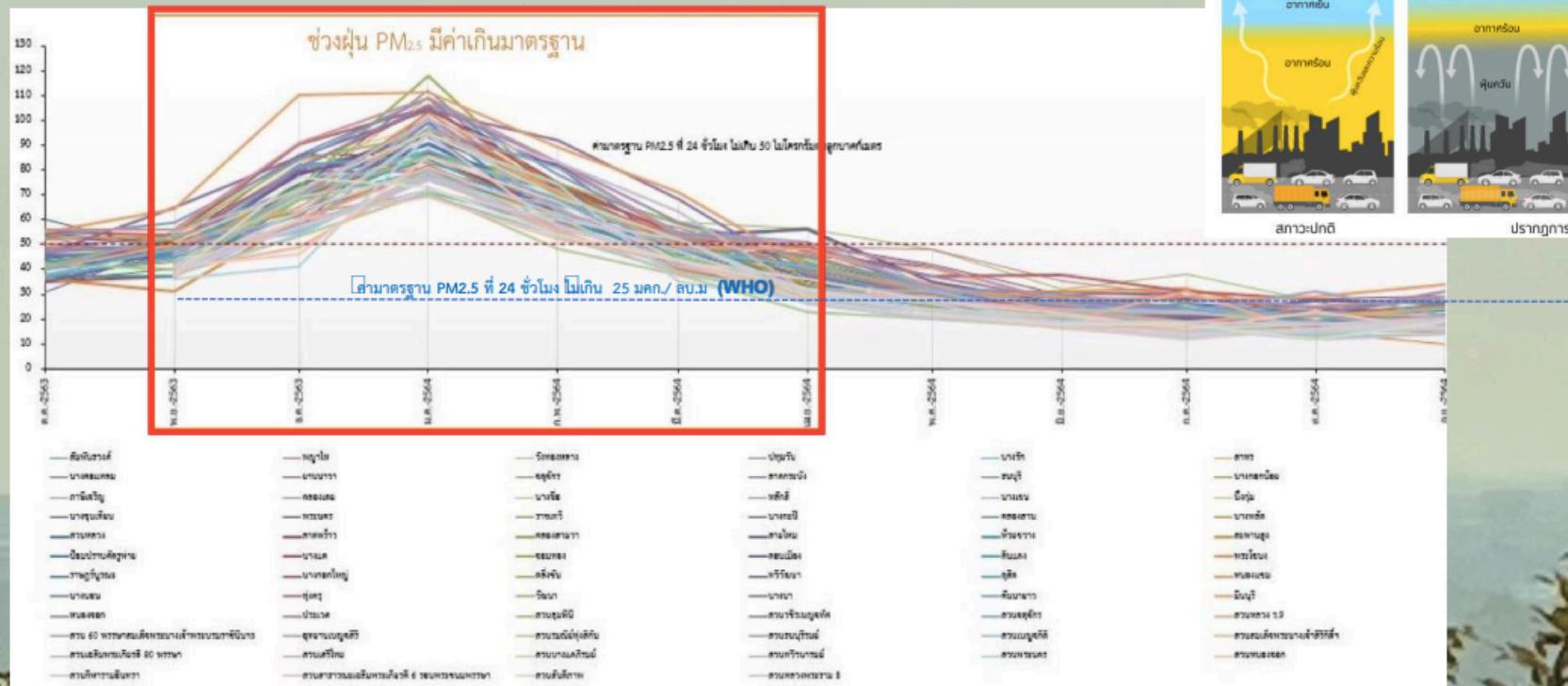
Recommendation	PM _{2.5} (µg/m ³)
Interim target 1	75
Interim target 2	50
Interim target 3	37.5
Interim target 4	25
AQG level	15

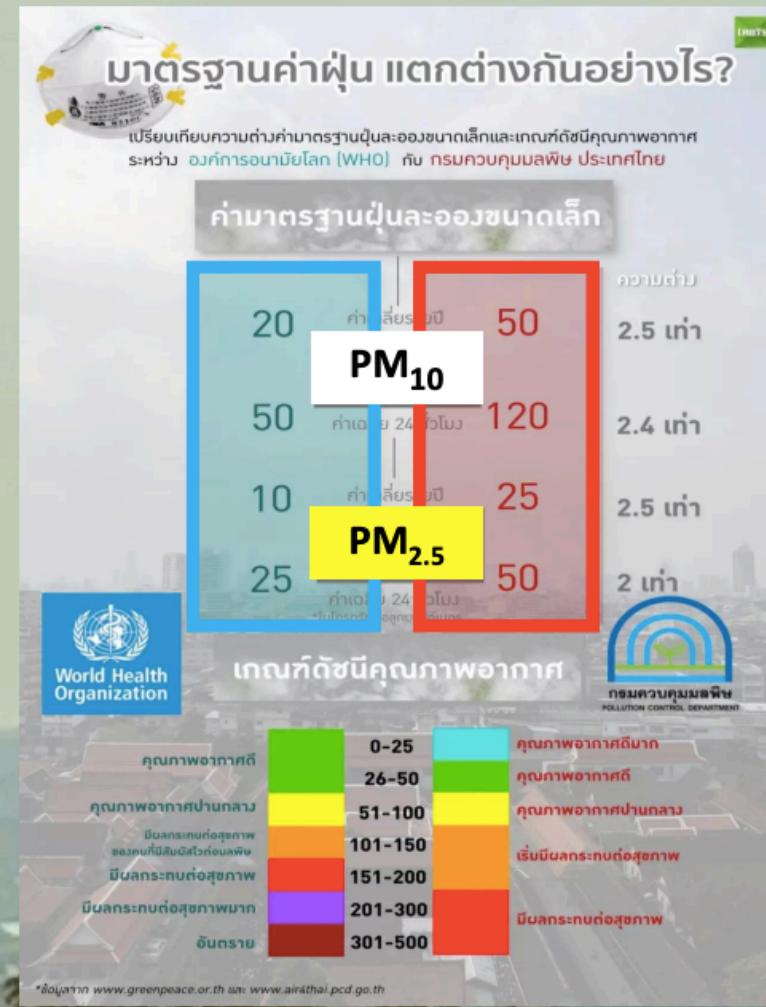
^a Defined as the 99th percentile of the annual distribution of 24-hour average concentrations (equivalent to 3–4 exceedance days per year).

Fig. 3.6. CRF of 24-hour average PM_{2.5} concentrations (µg/m³) and daily all-cause mortality, as observed in a joint analysis of data from 652 cities worldwide^a



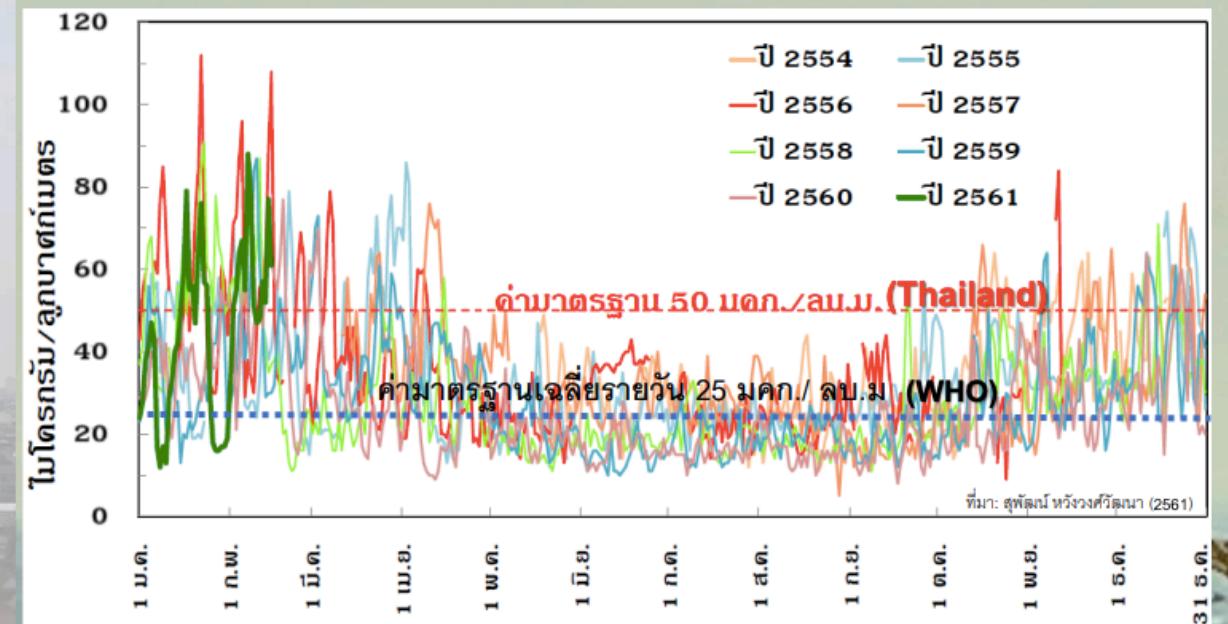
ผลการตรวจวัดค่าฝุ่นละอองในอากาศของ **PM_{2.5}** เฉลี่ย 24 ชั่วโมงสูงสุด
ระหว่างวันที่ 1 ตุลาคม 2563-14 กันยายน 2564





Air Quality Guidelines for PM_{2.5}

ความเข้มข้นฝุ่นละออง PM_{2.5} รายวัน ในพื้นที่กรุงเทพมหานคร ปี 2554-2561



Recommended 2021 AQG levels and 2005 AQG

Pollutants	Average time	Thailand: AQG (2553)	WHO,2005: AQG 2549	WHO,2021: AQG (update)
PM _{2.5} µg/m ³	Annual	25	10	5
	24- hour ^a	50	25	15
PM ₁₀ µg/m ³	Annual	50	20	15
	24- hour ^a	120	50	45
O ₃ µg/m ³	Peak season ^b	-	-	60
	8- hour ^a	140	100	100
NO ₂ µg/m ³	Annual	-	40	10
	24- hour ^a	320	-	25
SO ₂ µg/m ³	24- hour ^a	300	20	40
CO mg/m ³	24- hour ^a	-	-	4

^a 99th percentile (i.e. 3-4 exceedance days per year)

^b Average of daily maximum 8-hour mean O₃ concentration in the six consecutive months with the highest six-month running –average O₃ concentration.

Kutler Joss et al.,2017

WHO,2022



ขอบคุณครับ