

PM_{2.5} in Thailand

Mutchimwong A*

Faculty of Environment and Resource Studies, Thailand

ISSN: 2578-0336



*1**Corresponding author:** Auemphorn Mutchimwong, Faculty of Environment and Resource Studies, Thailand

Submission: 📅 December 11, 2019

Published: 📅 January 31, 2020

Volume 6 - Issue 5

How to cite this article: Mutchimwong A. PM_{2.5} in Thailand. *Environ Anal Eco stud.* 6(5). EAES.000648.2020.
DOI: [10.31031/EAES.2020.06.000648](https://doi.org/10.31031/EAES.2020.06.000648)

Copyright@ Mutchimwong A, This article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use and redistribution provided that the original author and source are credited.

Abstract

This mini review aims to indicate how radiation inversion had an impact on PM_{2.5} accumulation during the winter in Thailand. Smoke sky occurred in the North and South of the country was attributed to smoke from forest fire and burnings in farmlands during September–October (Rainy season) and March–April (Summer season). While the haze sky in the wintertime was rarely observed. Until January 2018 the haze of PM_{2.5} occupied the sky in Bangkok and major provinces for several days and returned in December 2018 - February 2019. The radiation inversion and subsidence inversion were observed during January–February 2019, the synergy of two inversions might cause haze sky of high PM_{2.5} level. Radiation inversion was able to produce a double increase to the moving 24-hour PM_{2.5}. If new target value of 24-hour PM_{2.5} will be applied by 2024, the reduction of PM_{2.5} emission based on radiation inversion's effect should be around 25%.

Keywords: PM_{2.5}; Winter haze sky; Thailand

Introduction

In Thailand, almost the past ten years, high 24-hour PM_{2.5} levels over the standard of 50 µg/m³ were observed in lower south of the country during September-October (Rainy season) due to transboundary smoke from Indonesian forest fire. In the North, smoke episodes regularly occurred during March-April (Summer season) from forest fire and burnings in farmlands sited in the North of Thailand and neighboring countries. During these episodes, the sky over the North and lower South of Thailand cover with smoke all day long. The violation of 24-hour PM_{2.5} levels were also found frequently in several urban areas during the wintertime (November-February). In the past, haze sky was observed for a very short period. Then it caught no public attention. Until the beginning of year 2018, the weather disruptive in Thailand might start, people in Bangkok and major provinces began to experience the whole-day haze sky for several days. The incident caught public attention. Repeatedly, the haze sky returned in December 2018 and last until the middle of February 2019. This later incident grew public anxious on health effects due to PM_{2.5} exposure.

Previously in 2010, PM_{2.5} was established the ambient air quality standards on the 24-hour mean concentration of 50 µg/m³ and the annual mean concentration of 25 µg/m³ [1]. The standards follow WHO - Interim Target 2 (WHO-IT2). Before PM_{2.5} standard was stipulated, mass concentrations of PM_{2.5} in ambient air were monitored by Department of Pollution Control (PCD) at three stations [2]. At Present, there are 63 PCD's automatic air quality monitoring stations in 33 provinces [3]. Additionally, PCD has included 24-hour PM_{2.5} into Thai Air Quality Index (AQI) as the 6th sub-index since November 2018 [4]. Public are able to access air quality information via website: Air4thai.pcd.go.th, and Application: Air4thai.

Discussion

Due to the phenomena of haze sky in the winter 2018 and 2019, PCD was asked from various public groups to prescribe more stringent PM_{2.5} standards that drove towards achieving the WHO Air Quality Guideline as soon as possible to ensure good health and well-being. Later, Thai authorities set action plans to move PM_{2.5} target from WHO-IT2 to WHO-IT3 for an annual mean concentration of 15 µg/m³ by 2021 and 24-hour mean concentration of

37.5 $\mu\text{g}/\text{m}^3$ by 2024. In addition, the stringent emission standards, EURO 5 and EURO 6, will be applied for new car by 2021 and 2022 respectively [3]. From PCD monitoring data since year 2011- 2018, it reveals that the annual mean $\text{PM}_{2.5}$ and 24-hour mean $\text{PM}_{2.5}$ were in the ranges of 9-41 $\mu\text{g}/\text{m}^3$ and 3-133 $\mu\text{g}/\text{m}^3$ respectively [5]. History records told the facts that there were a number of annual mean and 24-hour mean of $\text{PM}_{2.5}$ exceeded the standards. When the seasonal variation of 24-hour mean $\text{PM}_{2.5}$ was explored as illustrated in Figure 1. The figure shows in a pattern that the standard exceedance regularly occurred during January - March

and late December of the years. The exceedance occurred during the wintertime in Thailand. At the beginning of winter season (November), the weather from southerly monsoon, rainy season changes to the weather of high pressure, low temperature, and strong northeasterly wind spread over the country. It was happened naturally that in several consecutive periods during the winter, the weather changes to air stagnation conditions of calm wind and radiation inversion occurred during the nighttime, which hinders $\text{PM}_{2.5}$ dispersion, then promotes dust accumulation in the air.

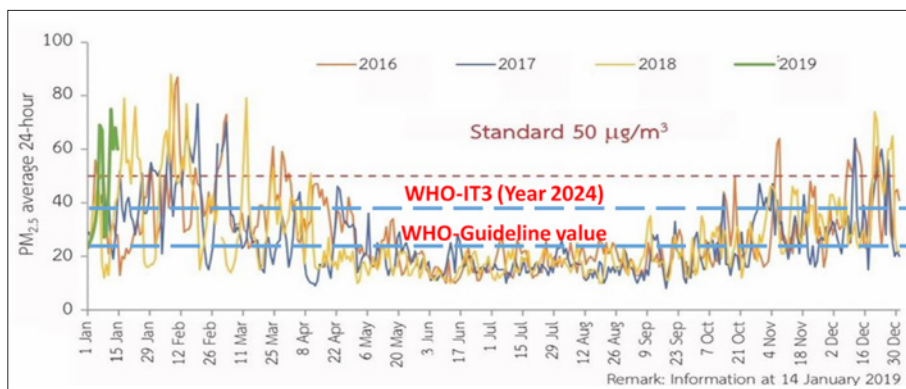


Figure 1: The 24-hour mean of $\text{PM}_{2.5}$ in Bangkok and suburban area in 2016-2019 [5].

During the winter haze episode in 2019, the author explored the weather data (e.g. wind speed, wind direction, surface temperature, sounding forecast) [6] and was surprisingly found that during the haze sky in January–February 2019, not only radiation inversion occurred during the night, but the subsidence inversion also existed at high altitude and covered parts of Thailand [7,8]. Hence, it may be anticipated that 2018-2019 winter haze sky of high $\text{PM}_{2.5}$ level was attribute to the synergy of radiation inversion and subsidence inversion. Effects of these natural phenomena were shown as examples from observations at a roadside station sited in Samut Sakhon Wittayalai School, Samut Sakhon Province at 10.00am. on January 25th, September 25th, and November 25th,

2019. It was found that 24-hour $\text{PM}_{2.5}$ levels observed at these dates were 95, 40, 61 $\mu\text{g}/\text{m}^3$ respectively [9,10]. Bar graphs of 1-hour mean $\text{PM}_{2.5}$ in Figure 2 illustrate $\text{PM}_{2.5}$ accumulation during the night with radiation inversion (12th-13th November 2019) and without radiation inversion (14th November 2019). The inversion was able to produce a double increase to the moving 24-hour $\text{PM}_{2.5}$ from light blue-line at background state to orange-line at inversion contribution state. Figure 2 also implies that, if new target value of 24-hour $\text{PM}_{2.5}$ will be applied by 2024, in order to maintain the moving 24-hour $\text{PM}_{2.5}$ levels below WHO-IT3 target, the reduction of $\text{PM}_{2.5}$ emission based on radiation inversion's effect should be around 25%.

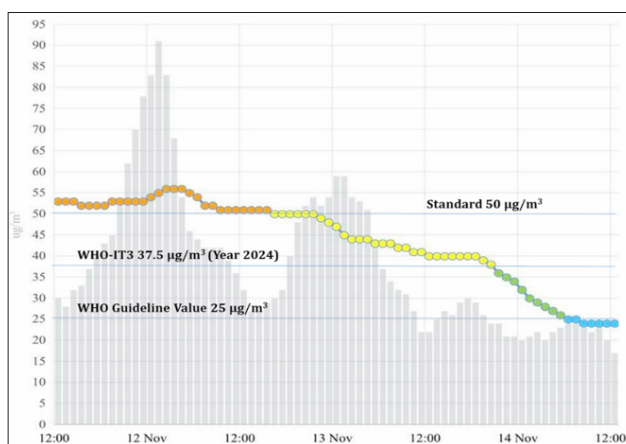


Figure 2: The 1-hour mean $\text{PM}_{2.5}$ (Bar graph) and moving 24-hour mean $\text{PM}_{2.5}$ (Colors-line graph) observed in November 2019 at an urban background station: National Housing Authority Klongchan Station, Bangkok [10].

Note: Color of line graph informs levels of health concern, when; Light blue=Very Good; Green=Good; Yellow=Moderate; Orange=Unhealthy; Red=Very Unhealthy.

Conclusion

Winter haze of $PM_{2.5}$ occupied the sky in Bangkok and major provinces for several days was observed in January 2018 and returned in December 2018-February 2019. The synergy of radiation inversion and subsidence inversion observed during the episode might cause haze sky of high $PM_{2.5}$ level. Radiation inversion was able to produce a double increase to the moving 24-hour $PM_{2.5}$. If new target value of 24-hour $PM_{2.5}$ will be applied by 2024, the reduction of $PM_{2.5}$ emission based on radiation inversion's effect should be around 25%.

References

1. Notification of National Environment Board No.36, B.E. 2553 (2010) The standard level of particle size no larger than 2.5 microns in the ambient air.
2. Pollution Control Department (2011) Annual report on state of air pollution and noise pollution 2010.
3. Pollution Control Department (2019) Action plan for driving national agenda on particulate matter mitigation.
4. Notification of Pollution Control Department: Thai air quality index.
5. Pollution Control Department (2019) Booklet on Thailand State of pollution 2018.
6. Windy (2019) Wind map & weather forecast.
7. Mutchimwong A (2019) Particulate matter no larger than 2.5 micron. Conference on air pollution and health impact. The Academic of Science, The Royal Society of Thailand, Thailand.
8. Mutchimwong A (2019) $PM_{2.5}$ and worker health. Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand (Oral Presentation).
9. Pollution Control Department (2019) Thailand's air quality and situation reports.
10. Pollution Control Department (2019) Air4Thai application: Report on the situation of air pollution in Thailand for environment and improve quality of life.

For possible submissions Click below:

[Submit Article](#)