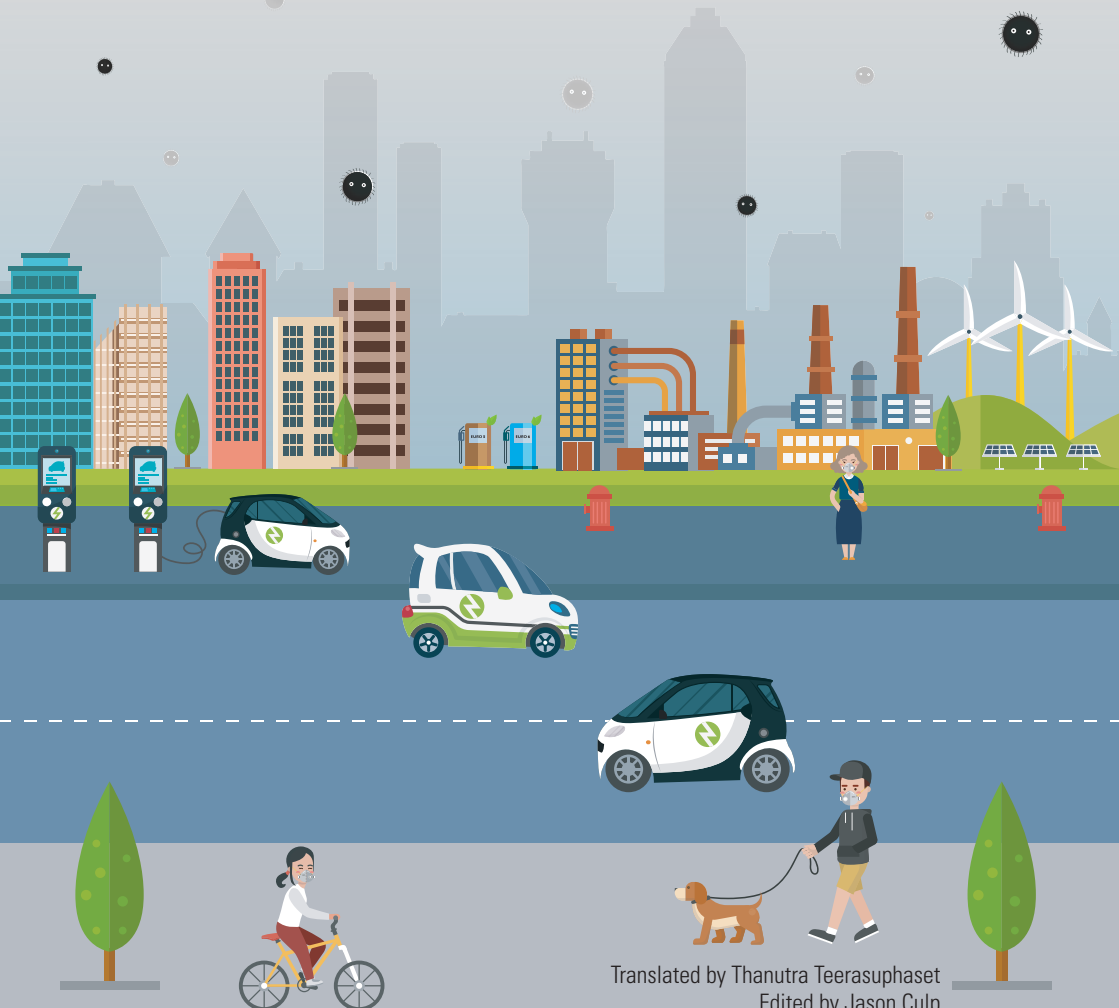




จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

STAY SAFE IN THE PM 2.5



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**STAY SAFE IN THE
PM 2.5**



Preface

'Air' is considered one of the basic elements of life, a necessity for the survival of humans and creatures alike. Unfortunately, the pollution of air with small particulate matter, or PM 2.5*, has raised concerns about the negative impact of air quality on several health conditions, including respiratory illness, heart health, and allergic symptoms affecting the eyes and nasal passages.

The problem of air pollution is a growing concern for the general public in Thailand. The Royal Government of Thailand had issued an official statement regarding the quality of air in the metropolis area of Bangkok, along with five surrounding provinces, followed by a city-wide action plan to mitigate the situation. During the periods of time that the air quality index indicated levels beyond what's considered safe for certain health conditions, public schools and education institutes would take precaution by declaring a holiday for students. Additionally, the air quality situation led to a demand that exceeded supply on N-95 protective face masks, while the number of hospital visits due to respiratory illness significantly increased.

Due to the lack of pertinent information available to the public, Chulalongkorn University is taking action to share knowledge and increase awareness in handling the situation of PM2.5, which will benefit the Thai population on protecting their health as well as encourage discussion on how to effectively address this issue. This "How to" manual is a collaborative effort developed with contributions from lecturers, experts and specialists from various faculties and fields to utilize knowledge, expertise, and academic research in order to educate and empower the public, fully embracing the famous quote 'Your health is in your hands.'

Chulalongkorn University

*PM 2.5 refers to atmospheric particulate matter (PM) with a diameter of less than 2.5 micrometers.

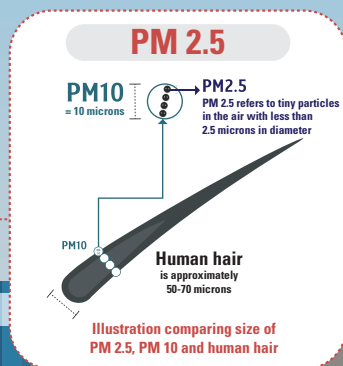


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What is PM 2.5?

PM 2.5 refers to particulate matter in the air with diameter of less than 2.5 microns and represents one of the eight established criteria in measuring air quality of the atmosphere. Earlier in 2019, Thailand had faced a critical haze situation which resulted in relevant stakeholders consisting of government agencies, the media, and general public, seeking more information about PM2.5 and the air quality issue.

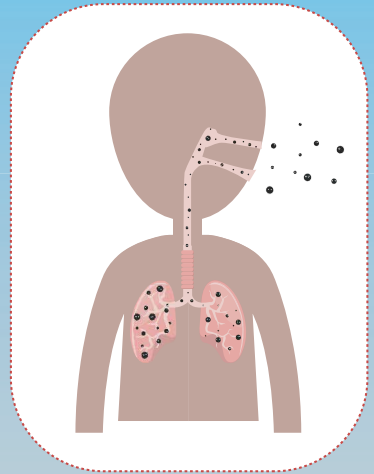


**Where does
PM 2.5 come from?**



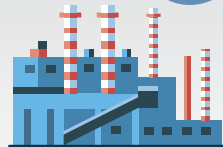
The major concern about these tiny particles is its ability to travel through the respiratory tract and deep into the lungs. PM 2.5 may not cause immediate harm to health; however, cumulative exposure over time can lead to various health disorders. One of the dangers related to PM 2.5 may be the role it plays in carrying other harmful environmental pollutants into the body through the adhesive properties of its outer layer, e.g. carcinogens, heavy metals, etc.

The presence and continuously increasing levels of these tiny particles has been a worsening issue in Thailand over the past few years, with regular cycles of safe to unsafe levels being reported weekly.



Air pollution caused by vehicles and traffic congestion.

According to information from the Pollution Control Department, diesel engine exhaust fumes and traffic congestion contributes as a major source of air pollution.



Pollutant emission from factories and power plants

Burning fossil fuels or environmentally non-friendly sources of fuel, specifically coal, contributes to air pollution as well.

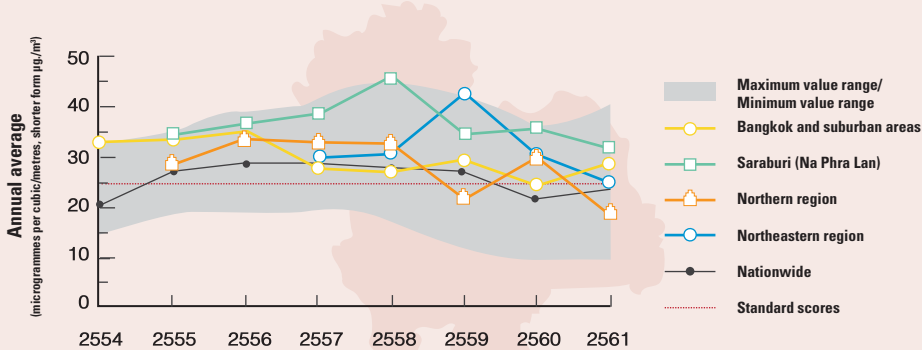


Open burning and Indoor burning

Burning of agricultural waste as a preparation for harvest, forest fire and waste disposal adds to the poor AQI.

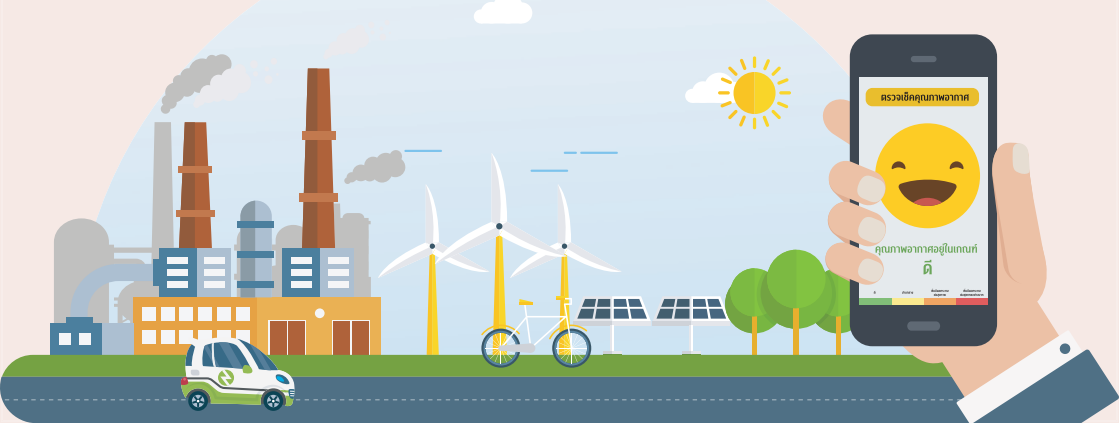
Although PM 2.5 has been an issue for a number of years, the fact that for this year the situation onset occurred earlier than the predicted regular cycle and has remained critical for a longer period of time when compared to previous years, has triggered concern and a need to raise awareness among the general public.

Graph indicates the forecast of level of PM 2.5 between B.E. 2554-2561 (A.D. 2011 – 2018)



PM 2.5 level increase usually occurs during transition between winter to summer season. Approaching the end of winter, high pressure areas or a cold air mass spreads from China to Thailand, resulting in strong monsoons covering the Northeast part of Thailand. At this time, the upper part of Thailand will experience lower temperatures, ranging from cool to cold, and potentially very cold in some areas. However, this may not occur if high pressure covering the area becomes less, which in effect will reduce the northeast monsoon season to a calm wind.

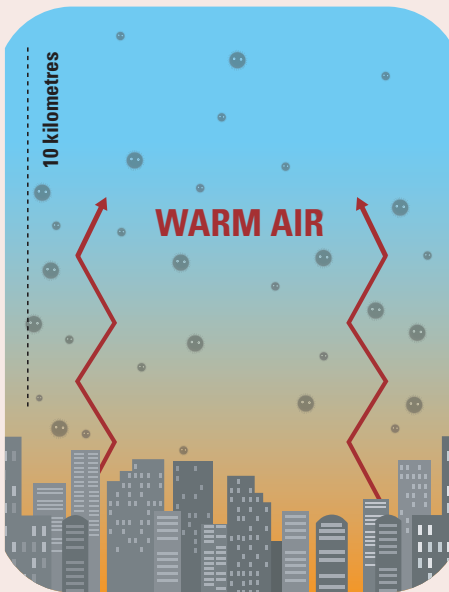
Temperature inversions in the lower parts of the atmosphere result in floating dust and distribution at a low level with poor air circulation and ventilation contributing to the accumulation of dust, smog and smoke in the atmosphere.



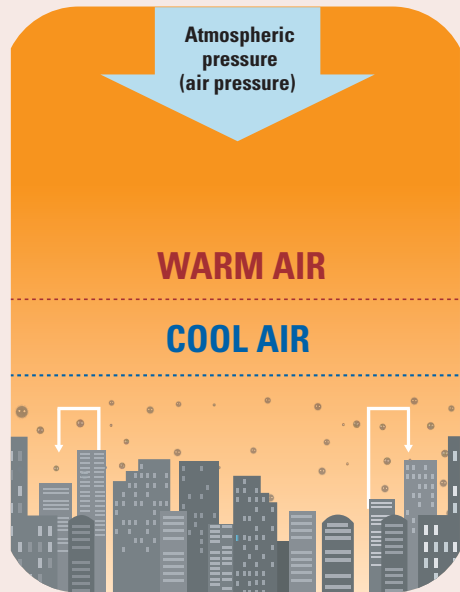
Do you know that 'climate condition' plays a role in the existence of 'PM 2.5'?

In addition to fuel combustion, climate conditions also play a role in creating the high PM 2.5 levels covering Thailand. During the period of time when the air becomes stagnant, the pollutants accumulate in the atmosphere and rise upward when the wind starts to flow and repeats its cycle. Recently, the wind has been calm for longer than usual, resulting in a cloud of ultra-fine dust particles accumulating in the air.

Weather condition



Weather condition with temperature inversions



Do you know how activities in the household can affect and cause pollution in the air?

1 Smoking



One roll of cigarette is made of tobacco leaf, rolling paper, and a multitude of different chemicals. When combustion starts, it will produce 4,000 types of chemicals. Even if there is no inhalation, the temperature at the tip of cigarette will be very hot and when smoke and the tip of cigarette touches the air, this activates a chemical reaction between nitrogen and oxygen, producing the toxic air constituent, nitrogen oxide.



2

Lighting up joss stick and candles

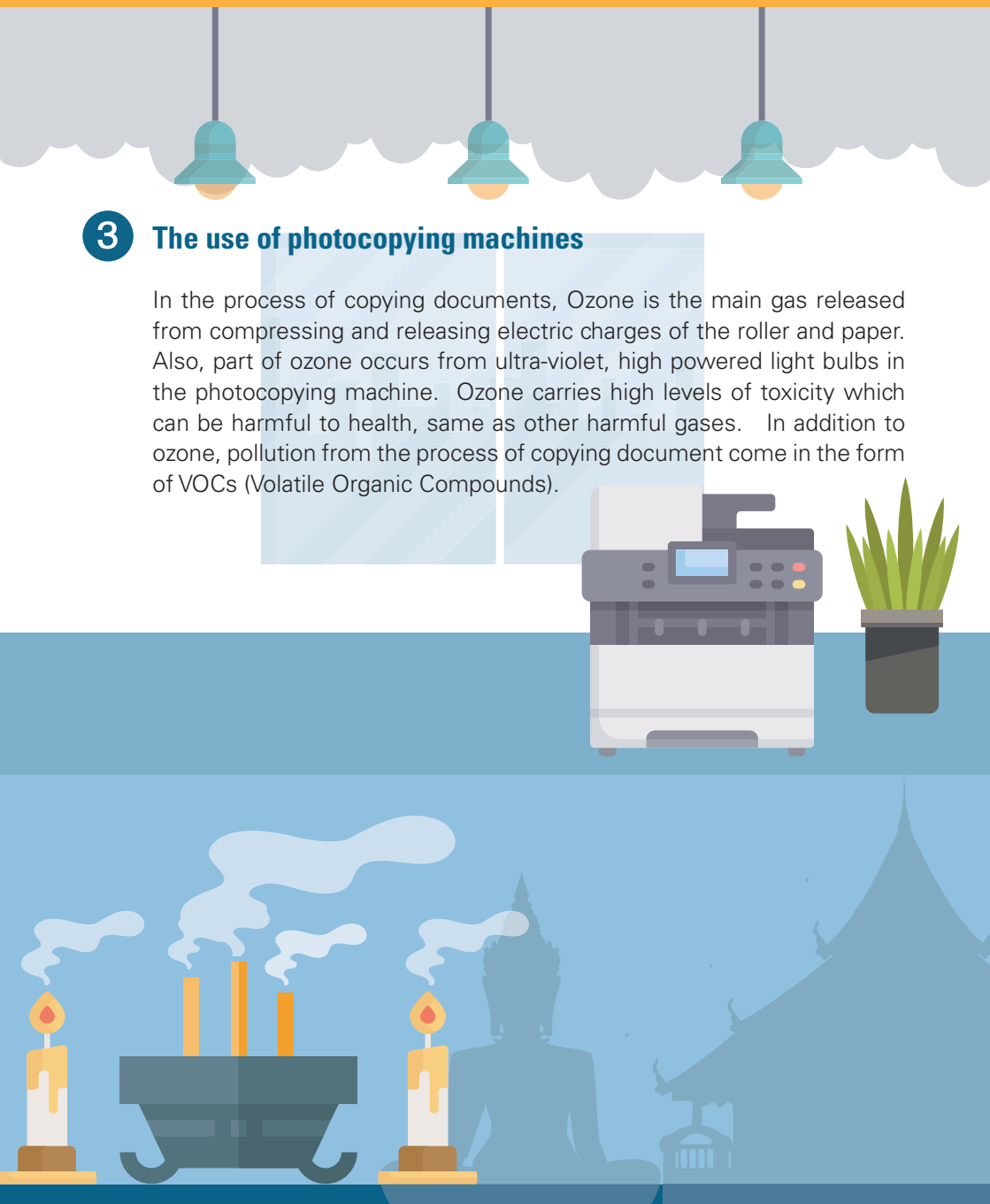


When we light up joss sticks, saw dust is burned. Glue and perfume in joss stick and various other substances will be released into the air, similar to cigarette smoke or pollution from exhaust pipe, contributing tiny dust, carbon dioxide, carbon monoxide, methane, sulphur dioxide, nitrogen dioxide and different types of carcinogens.

In addition, the candle lighting causes the release of lead during combustion, since lead is one of the components in the making of candlewick. Candle soot also contains traces of carbon from incomplete combustion.

3 The use of photocopying machines

In the process of copying documents, Ozone is the main gas released from compressing and releasing electric charges of the roller and paper. Also, part of ozone occurs from ultra-violet, high powered light bulbs in the photocopying machine. Ozone carries high levels of toxicity which can be harmful to health, same as other harmful gases. In addition to ozone, pollution from the process of copying document come in the form of VOCs (Volatile Organic Compounds).



What is the measurement of AQI?

Recently, in the news announcements about PM 2.5, you will notice ‘AQI’, the Air Quality Index, is referenced. Thailand has been using this index in reporting weather conditions as well. Since October 1, 2018, Thailand had included PM 2.5 into the calculation of AQI.

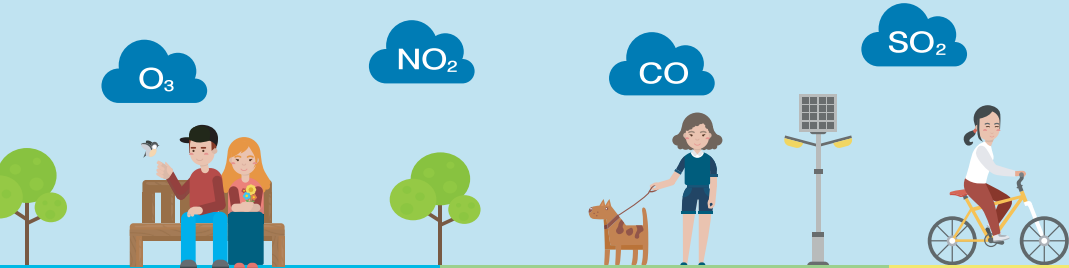
AQI: Air Quality Index

Air Quality Index is used in Thailand for calculating and comparing the five types of common air pollutants with the air quality standard in the general atmosphere. The calculated air pollutants include:

Air pollutants used for calculating AQI		Average duration/hour
1. Ozone gas	O ₃	8
2. Nitrogen dioxide gas	NO ₂	1
3. Carbon monoxide gas	CO	8
4. Sulphur dioxide gas	SO ₂	1
5. Dust	Size not exceeding 10 microns	24
	Size not exceeding 2.5 microns	






The highest type of air pollutant calculated will be used as the air quality index for that particular day. However, AQI is an index with no unit, the standard of PM 2.5 intensity separated into daily averages which is 50 microgram/cubic metre and annual average is 25 micro cubic metre.

The figures from hourly, daily or annual averages are incomparable as each substance is harmful in different quantities, hence the average considered to be safe will differ with each substance.

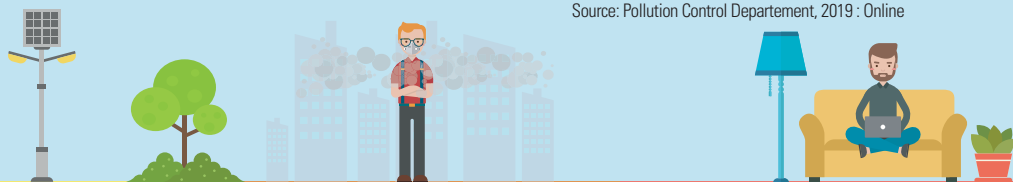


For high risk groups such as patients with respiratory disease, cardiovascular disease, children, the elderly and pregnant women should avoid highly-polluted areas which can be conveniently checked from the Air4Thai application developed by the Pollution Control Department.



Air quality	Definition	Explanation	
0-25	 Very good	Air quality is very good, suitable for outdoor activities and traveling.	
26-50	 Good	Air quality is good, able to do outdoor activities and travelling.	
51-100	 Fair	General public	People require special care.
		Able to do outdoor activities	If there are primary symptom such as cough, breathing difficulty, and eye irritation, duration of being outdoors should be reduced.
101-200	 Staring to create a health impact	General public	People require special care.
		Reduced time spending outdoor if you observe the following symptoms: coughing, harder to breathe, eye irritation. Wear protective equipment such as mask if needed	Reduced time spent outdoor and wear protective gear. Seek medical support if you have the following symptom: coughing, harder to breathe, eye irritation, irregular heartbeat rhythm, convulsion, tired, etc
200 and up	 Impact to health	Avoid outdoor activities and avoid the area with high pollutant concentration. Wear protective equipment if you need to go outdoor and consult a physician if you feel sick.	

Source: Pollution Control Department, 2019 : Online



Do you know? What the pollutants for measuring air quality consists of?

Source of pollution

Health effect

CO

Carbon monoxide

Carbon monoxide
Incomplete fuel combustion
and many other carbon
compounds from vehicles or
naturally

Immediate danger causing
dizziness, headache. Heart
disease patients may be
dangerously affected and in
the case of inhaling large
amounts, could result in
death.

O₃

Ozone

Ozone occurred from
reaction from the
atmosphere with affect from
sunlight.

Will have an effect on the
respiratory system and heart
muscle, irritation to the eyes
and nasal mucosa affecting
breathing function.

SO₂

Sulphur dioxide

Sulphur dioxide, combustion
of fuel with Sulphur, metal
mining which consists of
sulphur, some industrial
processes, volcanic ash.

Can cause many respiratory
illnesses, as well as
irritation to the eyes and
nasal mucosa.





Source of pollution

Health effect

NO_2

Nitrogen dioxide

Nitrogen dioxide, vehicles, burning at high temperature, chemical reactions in the atmosphere

Respiratory illness

Pb

Lead

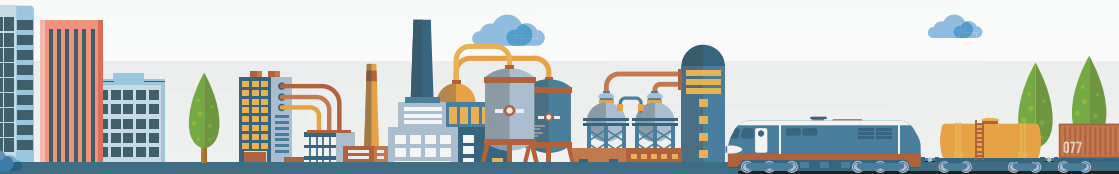
Naturally from mining, smelting lead, vehicles and industrial factories, items requiring lead for manufacturing such as batteries

If collected in the body, can cause kidney disease, and damage the Central nervous system.

Dust

Incomplete combustion of fuel, construction and industrial processes, chemical reactions in the atmosphere.

Causing harm to respiratory system, coughing or sneezing. A collection of toxic substances found in dust may cause higher rates of premature death.



Government policy

During the dust crisis, people have to find ways to manage anxieties due to the fear of inhaling pollution into the body. Solving the problem by giving away masks or spraying water in the areas with high traffic (only considered effective for large dust particles) is not considered solving the root cause. As a consequence, dust density is persistent and causing inconvenience for commuters, including the hazards for pedestrians and motorcyclists travelling along roads during spraying water, which may lead to accidents due to low

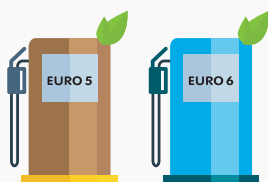


Apart from spraying water to reduce the dust, Government sectors had discussed to launch measures to relieve dust problems in short term such as reducing vehicles with black smoke emissions, prohibiting vehicles with diesel engines to run or forbidding people to burn rubbish.



These measures are considered only temporary solutions and not addressing the root cause, facing challenges from law and regulation. Hence, the need to gather suggestions for long term measures (policy level) from all sectors and departments to help solve this problem sustainably. These suggestions are as follows:

Solving PM 2.5 problem in the long term



Replacement of fuel

Changing from the standard Euro 4 to Euro 5 and eventually to Euro 6



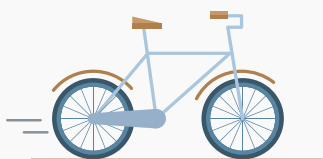
Development of integrated urban planning

Incorporating the initiative of reducing pollution to be part of urban planning.



Replacement of delivery trucks with electric vehicles.

Replacing all types of public transport vehicles owned by government and private sectors with electric vehicles.



Promote travelling without engines

Arranging to have NMT or Non-motorized Transportation which are practical and user-friendly to encourage and change the habits into using transportation without engines while promoting the health of the population.



Collect Eco Tax

Collecting environmental tax or fees according to the principle 'Polluter Pays Principle' (PPP) which are Pollution taxes and permits.

The above-mentioned measures are suitable for urban planning of big cities such as Bangkok only. As in other regions, different arrangements may be required. These measures may not be implemented effectively yet but everything counts to help reduce the dust problem in the long term. It is very important that the Government sectors should continue to find solutions and effectively control and manage this problem.

Recommended Precautions



After we get to know about tiny dust PM 2.5 as well as the countermeasures of the Government sector, we should also know how to prevent and protect ourselves.

Many household activities could be the cause of dust and air pollution such as smoking, lighting of joss sticks and candles, cooking with charcoal or firewood as well as office activities like the use of photocopying machine. Self-care practices when encountering dusty environments such as wearing the N95 mask, will help to filter dust particles, especially when worn outdoors.



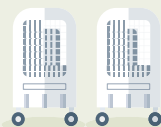
N95 mask

Easy tips for Long term prevention



1 Improvement of air quality in your residence

by ensuring proper ventilations is in place with regular cleaning and maintenance.



2 Installation of equipment to help reduce dust.

It is recommended to learn the mechanism of the equipment in order to understand the appropriate usage and maintenance i.e. cleaning of filter sheets on a regular basis depending on frequency of use.



3 Plant trees to help reduce pollution

Sample of plants with ability to absorb dust and polluted substances



Perennial plants with ability to absorb dust are listed as follows:



Acacia



Tamarind



Ironwood



Jackfruit



Golden dewdrop



Mango



Olive

Perennial plants with ability to absorb Carbon dioxide gas are listed as follows:



Golden shower



Purple orchid



Ebony



Red beach



Siamese rough bush



Sea almond



Jackfruit



Thai bungor



Mataraton



Fig



Guava



Deviltree

Ornamental plants with the ability to absorb polluted substances are listed as follows:



Butterfly palm



Lady palm



Golden pothos



Small ficus



Umbrella tree



Spider plant



Cornstalk plant

“ **Dust problems** are not new and doesn't have an easy solution as long as we continue to consume energy without consideration of consequences to the planet. With everyone's cooperation and contribution to reduce air pollution, the quality of air will be brought back to safe levels and subsequently improving the quality of life and wellbeing for all. ”

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