# nafas

Bringing air quality data to everyone in Indonesia

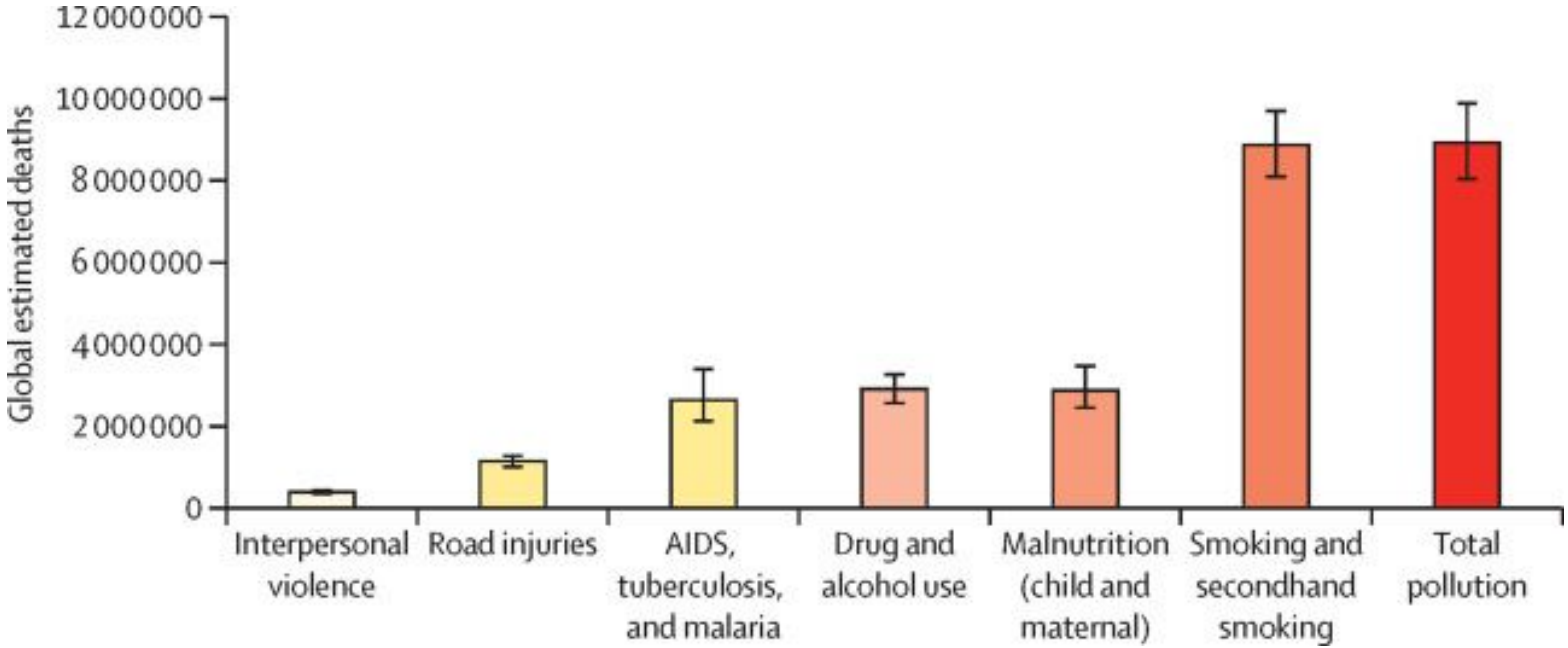
# What is the air pollution problem?

# Air pollution has been a problem for decades, with coverage in mainstream media increasing recently

Source: National Geographic April 2021 issue

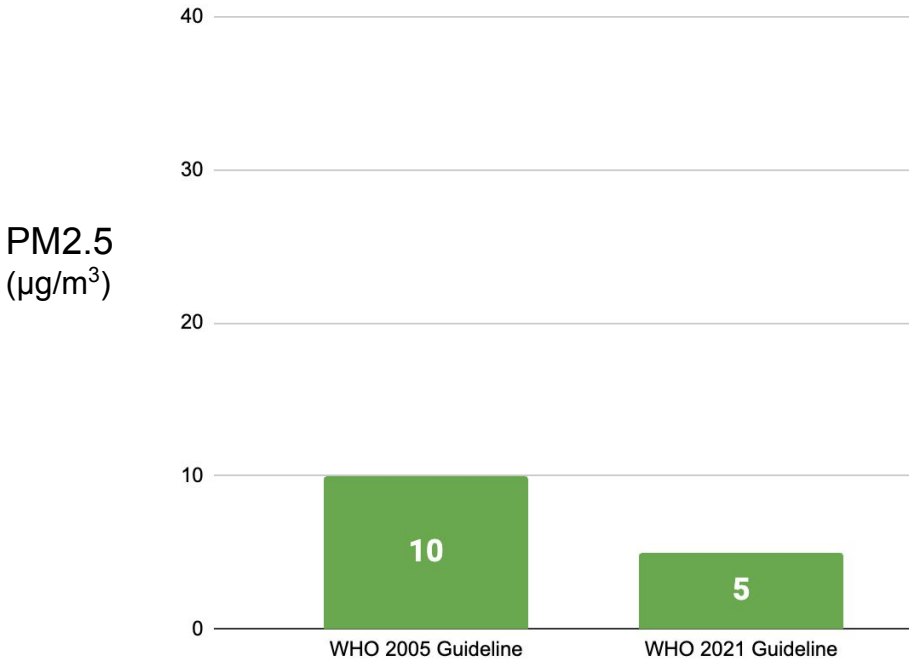
Source: Nikkei Asia, April 2021 issue

# Air pollution has been highlighted as the main contributor to preventable disease - now even higher than smoking




*Source: The Lancet, May 2022 (click here)*

# In 2021, the World Health Organization revised its yearly exposure standards for the main pollutants, including PM2.5

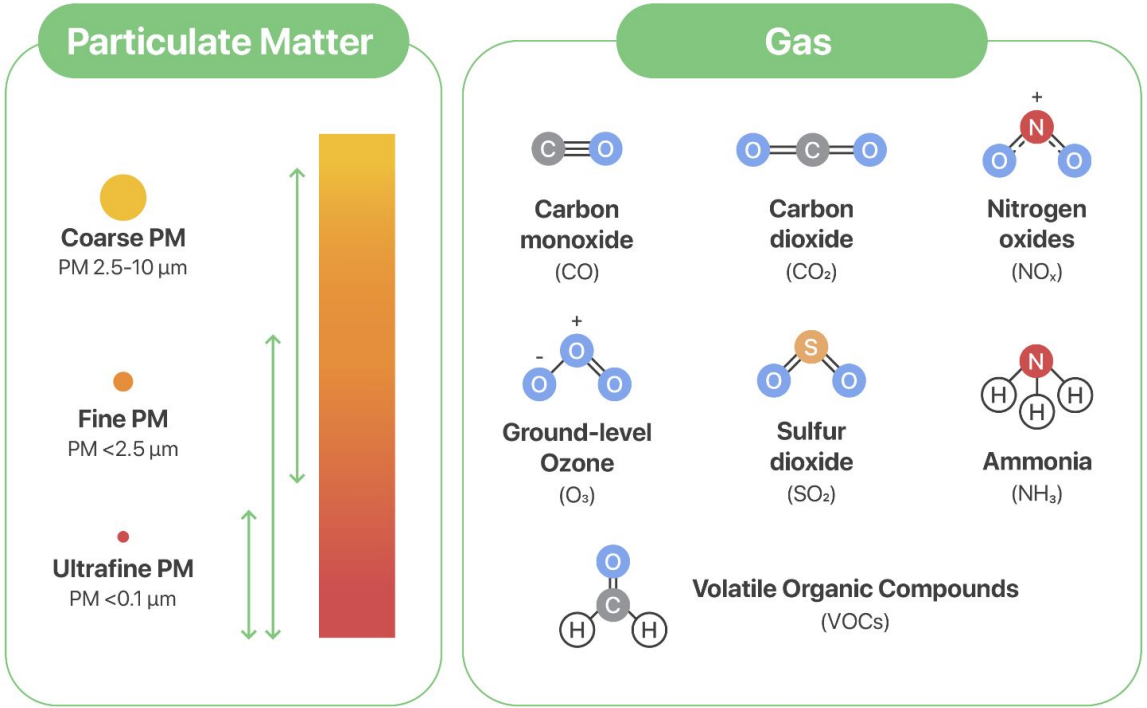



From 2005, the World Health Organization guideline for yearly PM2.5 exposure was 10 µg/m$^3$

After 16 years of research and very clear evidence, the guideline has now been revised down to 5 µg/m$^3$

Click here to read the release.
Click here to read the report.

# Air Pollution

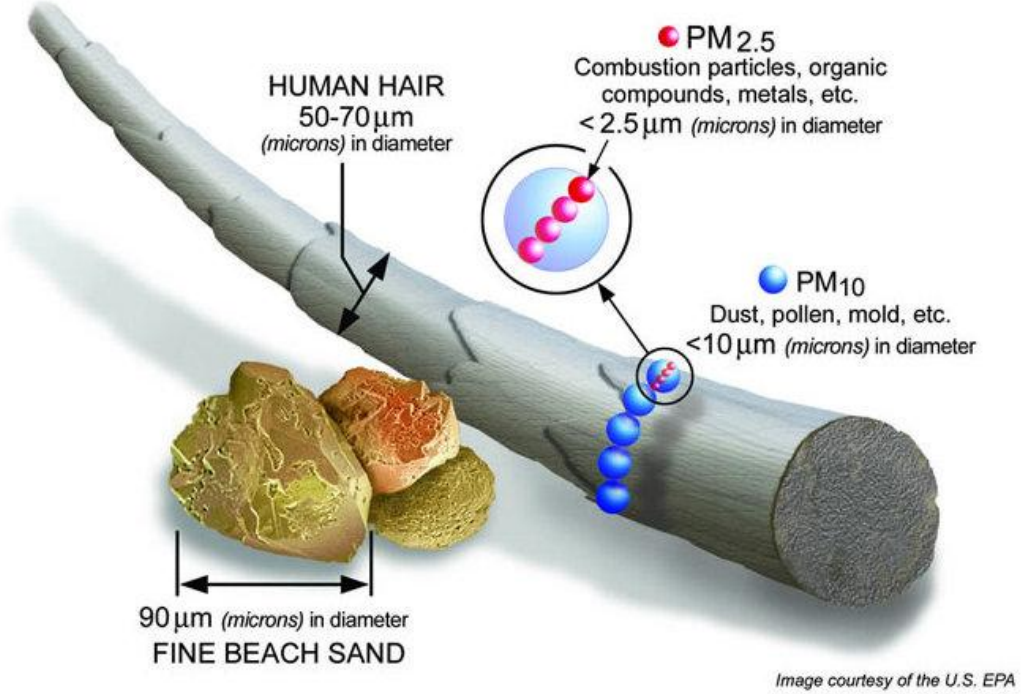



**In general, air pollution can be classified into two types:**

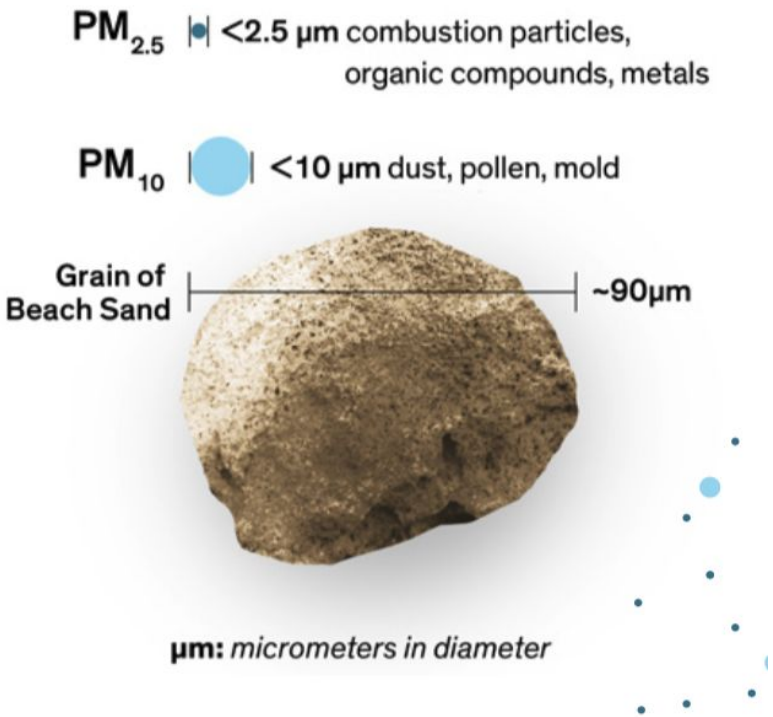
**Solid - Particulate Matters**

**Gases**

The pollutant that we will focus on primarily is **Particulate Matter 2.5 (or PM2.5)**, which is a particle/solid.



# PM2.5 is one of the biggest health risks from air pollution




PM2.5 = Particulate Matter 2.5 Microns

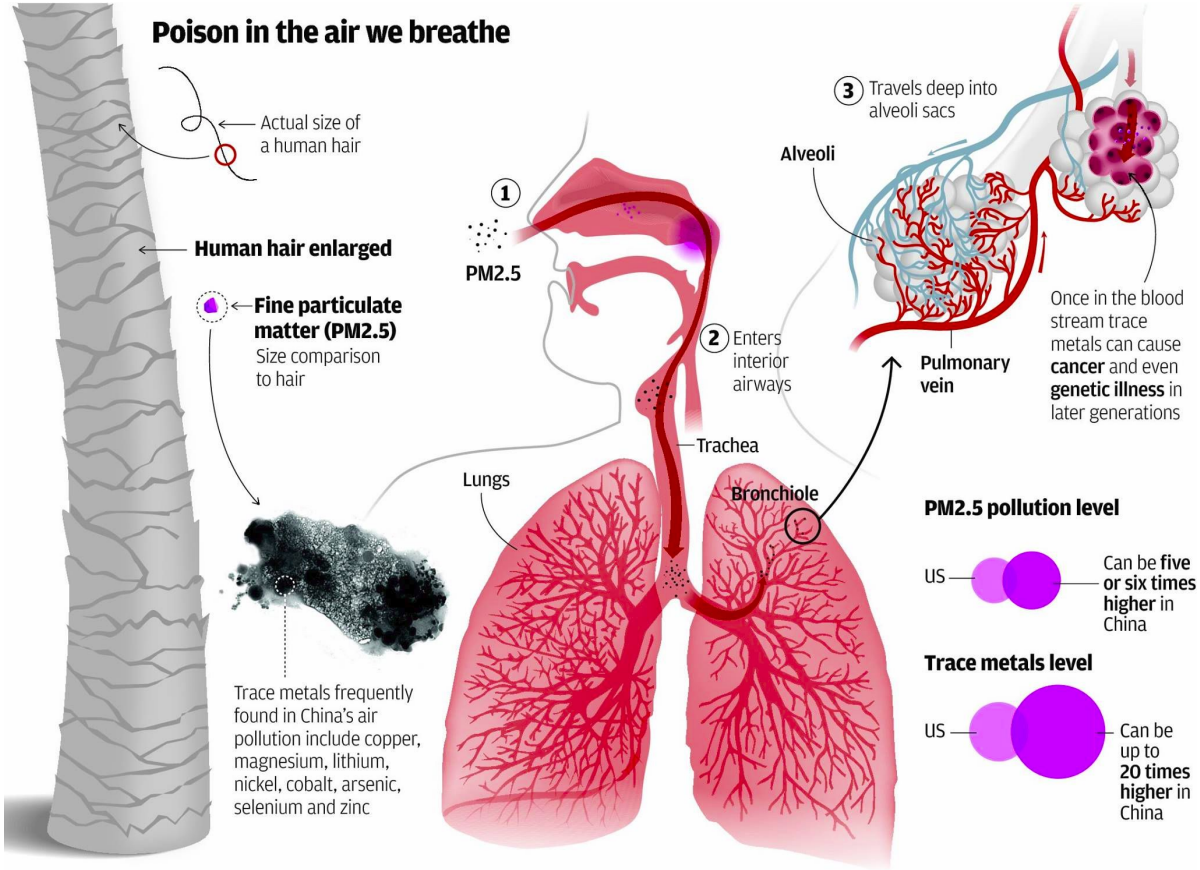
Smaller than a red blood cell

Cannot be filtered out by the human body

Small enough to enter our bloodstream

©2022 Nafas, All rights reserved

# Why is PM2.5 dangerous to our body?




Sources:EPA, Environmental Protection Department, Greenpeace.

SCMP Graphic: Adolfo Arranz

PM2.5 particles, when inhaled can go very deep into our lungs.

Inside our lungs, PM2.5 particles can enter our bloodstream - where they are treated the same way as other foreign objects.

Once inside our body, PM2.5 cannot get out.

©2022 Nafas, All rights reserved

# PM2.5 pollution can cause various health problems across our entire life-cycle

Premature Birth
Low Birth Weight
Miscarriage

Asthma
Reduced Lung Development
Reduced Neurological Development
Coughing and Wheezing
ADHD
Autism

Asthma
Coronary Heart Disease
Stroke
Lung Cancer
Chronic Bronchitis
Diabetes
Upper Respiratory Infections

Asthma
Lung Cancer
Diabetes
Dementia
Stroke
Heart Attack
Heart Failure
Poor Lung Function

WHO data shows that **9 out of 10 people** breathe air full of pollutants

*©2022 Nafas, All rights reserved*

# PM2.5 Pollution Makes Us Dumber

SCIENTIFIC AMERICAN

## Urban Air Pollutants Can Damage IQs before Baby's First Breath

A study in Krakow, Poland, corroborates New York City findings that link children's lower IQ scores with mothers' exposure to compounds created by burning fossil fuels

By Marla Cone, Emily Elert, Environmental Health News on July 26, 2010

UN environment programme 50 1972-2022

11 OCT 2018 | STORY | AIR

## Air pollution linked to "huge" reduction in intelligence

CaliforniaHealth REPORT

## Teen Exposure to Air Pollution Could Reduce IQ Levels Long Term

By Claudia Boyd-Barrett • Jan 31, 2018

©2022 Nafas, All rights reserved

# PM2.5 Pollution Makes Us Sicker

Harvard TH Chan School of Public Health

**Air pollution linked with increased risk of autism in children**

Exposure to fine particulate air pollution (PM2.5) has been linked with significantly increased risk of autism spectrum disorder (ASD) in children, ...

1 month ago

News Medical

**Children exposed to air pollution may be at higher risk of disease in adulthood**

Children exposed to air pollution may be at higher risk of disease in ... all the more important to determine how air pollution will affect long-term ...

22 Feb 2021

USNews.com

**Air Pollution Can Harm Kids' Hearts for a Lifetime**

Children experienced increases in blood pressure if they had short-term exposure to air polluted with coarser particles or long-term exposure to ...

3 weeks ago

News Medical

**HKBU scientists find significant link between PM2.5 exposure and neurological disorders**

It also showed that the risk of stroke in heavily polluted areas is higher than ... which emphasizes the health effects of air pollution.

1 week ago

Times Now

**Long-term exposure to low air pollution increases risk of heart, lung damage among older adults**

It was found that long-term exposure to even low levels of air pollution led to an increased risk of pneumonia, heart attack, stroke, and...

23 Feb 2021

Air Quality News

**Air pollution increases risk of stroke, new study**

Exposure to air pollution can increase the risk of stroke in people who already suffer from heart problems, according to a new study...

16 Sep 2020

50% of hospital admissions in DKI Jakarta are related to air pollution

©2022 Nafas, All rights reserved

# PM2.5 Pollution Makes Us Die Earlier

NIKKEI ASIAN REVIEW

THE BIG STORY

## Air pollution: Asia's deadliest public health crisis isn't COVID

As governments fail to curb the world's worst air, millions are dying avoidable deaths

Bloomberg

Politics & Policy

## Air Pollution Kills Far More People Than Covid Ever Will

More than 10 million people die every year from a problem that doesn't receive the attention it should.

NATIONAL GEOGRAPHIC

## Air pollution kills millions every year, like a 'pandemic in slow motion'

Dirty air is a plague on our health, causing 7 million deaths and many more preventable illnesses worldwide each year. But the solutions are clear.

©2022 Nafas, All rights reserved

# PM2.5 Pollution in Jakarta reduces life expectancy by up to 5.7 years

Download report disini - [Indonesian]

# Air pollution has a higher impact on children under 5

News Medical

**Children exposed to air pollution may be at higher risk of disease in adulthood**

Children exposed to air pollution may be at higher risk of disease in ... all the more important to determine how air pollution will affect long-term ...

22 Feb 2021

The Guardian

**Air pollution linked to 'huge' rise in child asthma GP visits**

A "huge" increase in the number of visits to doctors by children with asthma problems occurs after a week of raised air pollution, according to a ...

1 week ago

CNN

**Exposure to dirty air in the world's most polluted region linked to pregnancy loss, study finds**

(CNN) Pregnant women in South Asia who have been exposed to air pollution face an increased risk of pregnancy loss, miscarriage, and ...

6 Jan 2021

The Campus

**Air pollution may lead to poor mental health in children**

Air pollutants, such as smog, soot, greenhouse gases and other chemicals, have long been known to be harmful to human health and to the ...

3 weeks ago

News Medical

**Early exposure to air pollutant may contribute to non-atopic childhood asthma**

Asthma afflicts more than 300 million people worldwide. The most severe manifestation, known as non-Th2, or non-atopic childhood asthma, ...

1 month ago

Harvard TH Chan School of Public Health

**Air pollution linked with increased risk of autism in children**

Exposure to fine particulate air pollution (PM2.5) has been linked with significantly increased risk of autism spectrum disorder (ASD) in children, ...

1 month ago

Study Finds

**Air pollution can cause high blood pressure in children and increases their risk as adults**

A recent study finds exposure to air pollution can lead to high blood pressure in children. Even if they avoid the condition during adolescence, ...

2 days ago

USNews.com

**Air Pollution Can Harm Kids' Hearts for a Lifetime**

Children experienced increases in blood pressure if they had short-term exposure to air polluted with coarser particles or long-term exposure to ...

3 weeks ago

# And it’s also linked to some everyday problems too

News Medical

Air pollution can increase severity and hospitalization in COVID-19 patients with pre-existing respiratory conditions

Particulate matter is very small, small enough to be inhaled deep into the lungs, they cross into the blood and also affect other organ systems. Air ...

1 month ago

News Medical

Air pollution may have a detrimental effect on people's cognitive skills later in life

A greater exposure to air pollution at the very start of life was associated with a detrimental effect on people's cognitive skills up to 60 years later ...

2 Feb 2021

Newsweek

Trouble Sleeping? Air Pollution May Be to Blame, Study Says

"These new findings indicate the possibility that commonly experienced levels of air pollution not only affect heart and lung disease but also sleep ...

22 May 2017

Everyday Health

Is Air Pollution Making Asthma Worse?

How Air Pollution Makes Asthma Worse. At very high concentrations, air pollution can irritate the airways of the lungs and induce inflammation, ...

1 day ago

News Medical

Long-term exposure to air pollution can increase cardiovascular and respiratory risks

Air pollution can cause harm to the cardiovascular and respiratory systems due to its effect on inflammation in the heart and throughout the body.

22 Feb 2021

The News Minute

If you are struggling with a persistent cough, air pollution could ...

If you are struggling with a persistent cough, air pollution could be affecting your lungs. As our cities get more polluted, asthma and chronic ...

17 May 2019

BBC

Toxic air puts six million at risk of lung damage

Air pollution is a major health issue in the UK, says Dr Nick ... "Sometimes it can be so bad I'm actually sick because of the coughing.".

11 Feb 2021

# Here are some of our favorite stories

New York Times
https://www.nytimes.com/interactive/2020/12/17/world/asia/india-pollution-inequality.html

Forbes
https://www.forbes.com/sites/scottcarpenter/2021/02/10/fossil-fuel-air-pollution-kills-nearly-as-many-as-cancer-study-finds/?sh=22422f4e1dba

Nikkei Asia Review
https://asia.nikkei.com/Spotlight/The-Big-Story/Air-pollution-Asia-s-deadliest-public-health-crisis-isn-t-COVID

National Geographic
https://www.nationalgeographic.com/magazine/article/air-pollution-kills-millions-every-year-like-a-pandemic-in-slow-motion-feature

# Where does air pollution come from?

There are 3 types of sources of air pollution around the world related to human activities

# These are sources of air pollution too....

Cooking Food

Burning Garbage

Fogging For Mosquitos

# Air Pollution Formula

## How Bad Pollution Gets = Sources x Our Atmosphere

### “Producers” of Pollution

Stationary
Area
Mobile
Nature

### “Manipulators” of Pollution

Geography
Atmosphere
Temperature
Wind
Rain

# Air Pollution Formula

## How Bad Pollution Gets = Sources x Our Atmosphere

**WE HAVE FULL CONTROL**

“Producers” of Pollution

Stationary
Area
Mobile
Nature

**WE HAVE NO CONTROL**

“Manipulators” of Pollution

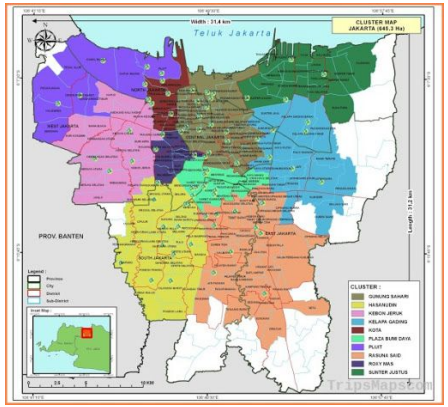
Geography
Atmosphere
Temperature
Wind
Rain

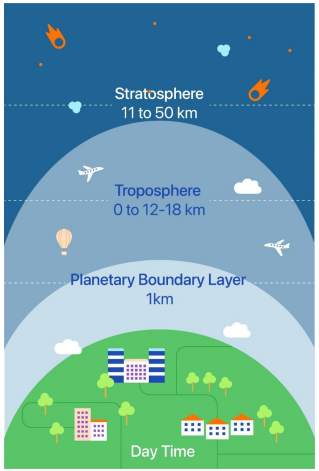
# Air Pollution x Climate Change Is A Circular Problem

**Burning of fossil fuels increases concentration of air pollutants**

**Burning of fossil fuels contributes to changes in weather. Changes in weather can impact air pollution by making it worse.**

# Geography, Atmosphere and Weather all impact how air pollution behaves in our environment



**Geography**

The position of coasts, mountains, elevation all play a role in how pollution behaves

**Atmosphere**

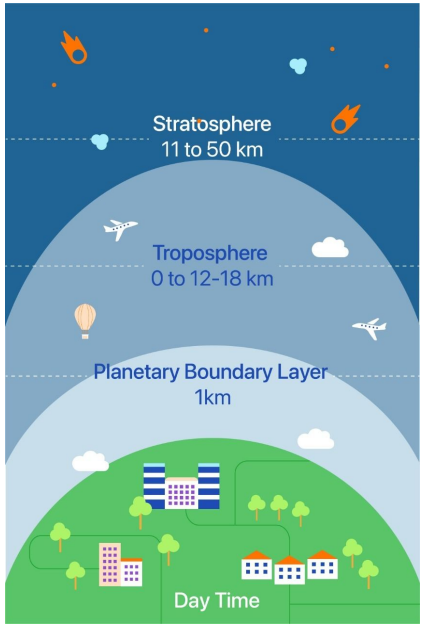
The Planetary Boundary Layer (or Atmospheric Boundary Layer) impacts pollution concentrations

**Weather**

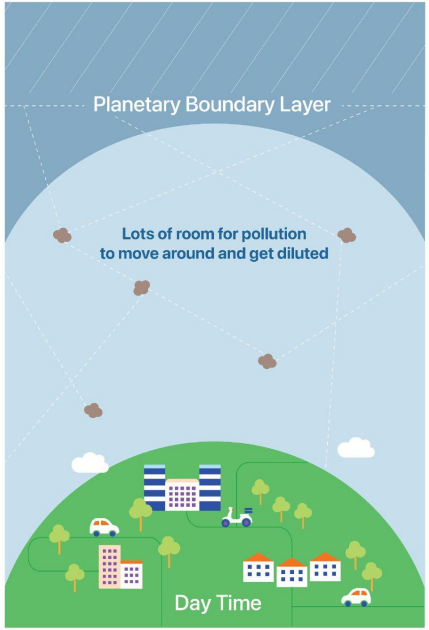
In the dry season (in Indonesia), the absence of wind impacts pollution signifcantly

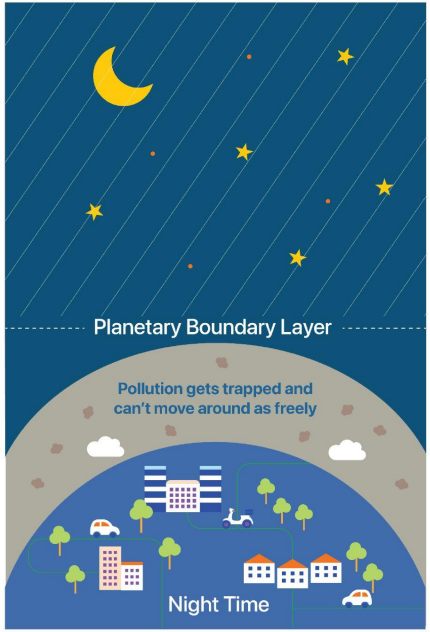
*More on this will be visible in the “5 Key Learnings about Air Pollution” section*

# What is the Planetary Boundary Layer?




The Planetary Boundary layer is within the Troposphere, and can fluctuate between 100m and 3km from ground level



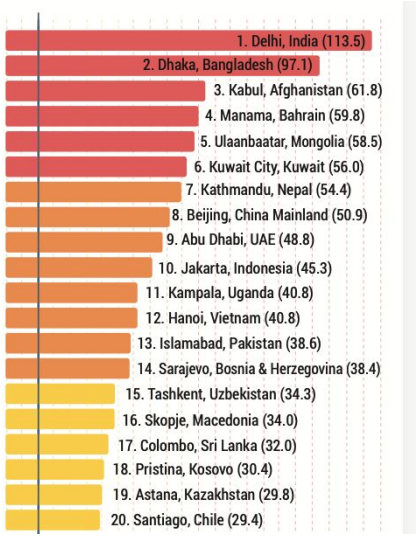

In Jakarta, during the day the Planetary Boundary Layer (PBL) expands, meaning that air pollution particles have a lot of space to move around, making air quality readings better than at night.

At night, the PBL becomes smaller, meaning that the same air pollution particles have a lot less space to move around, making air quality readings worse at night.

You can read more about it here: https://link.nafas.co.id/N2UY/dfe5f80a

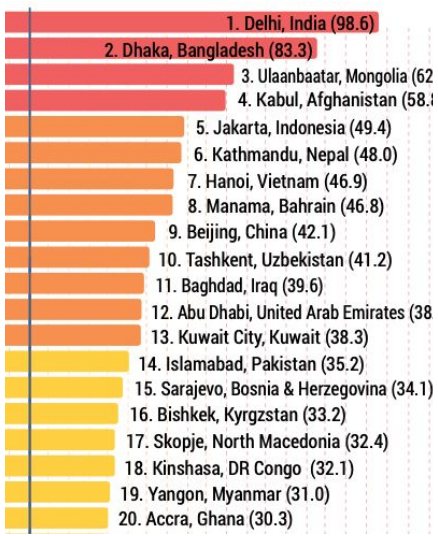
# Jakarta has frequently been ranked in the list of capital cities with the worst air quality in the world

**2018**



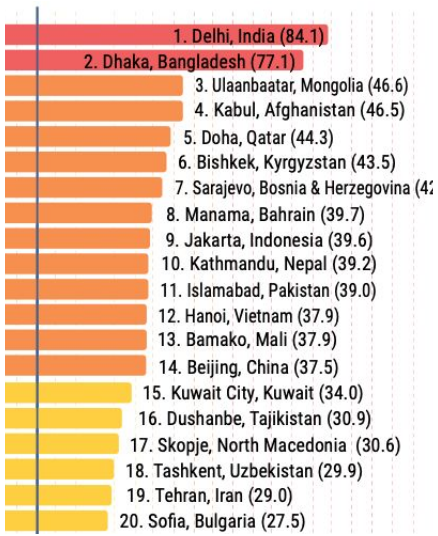

**Ranking**
10/62

**2019**



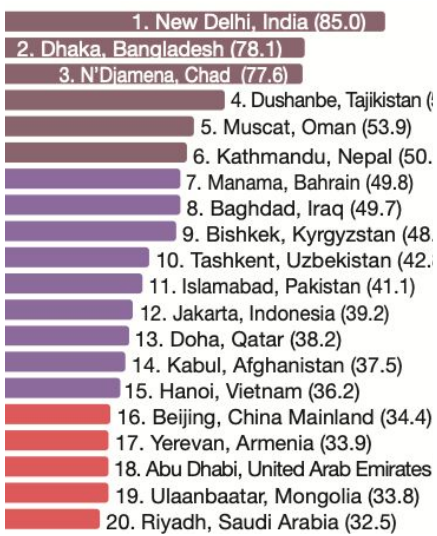

**Ranking**
5/85

**2020**




**Ranking**
9/92

**2021**

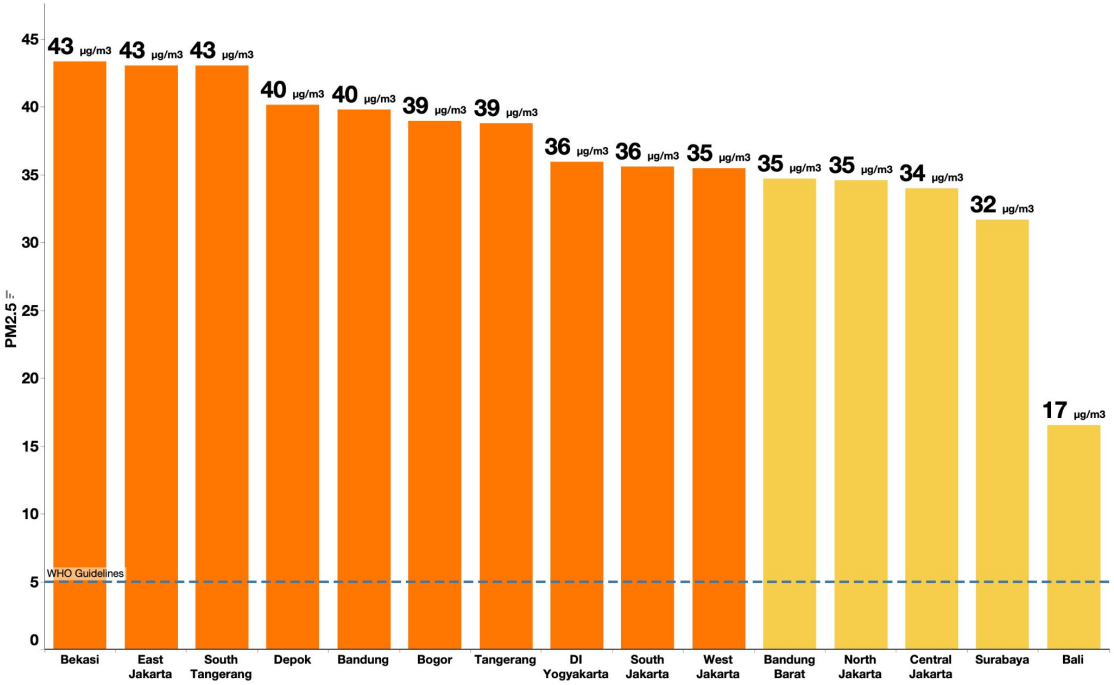



**Ranking**
12/107

*Source: IQAir*

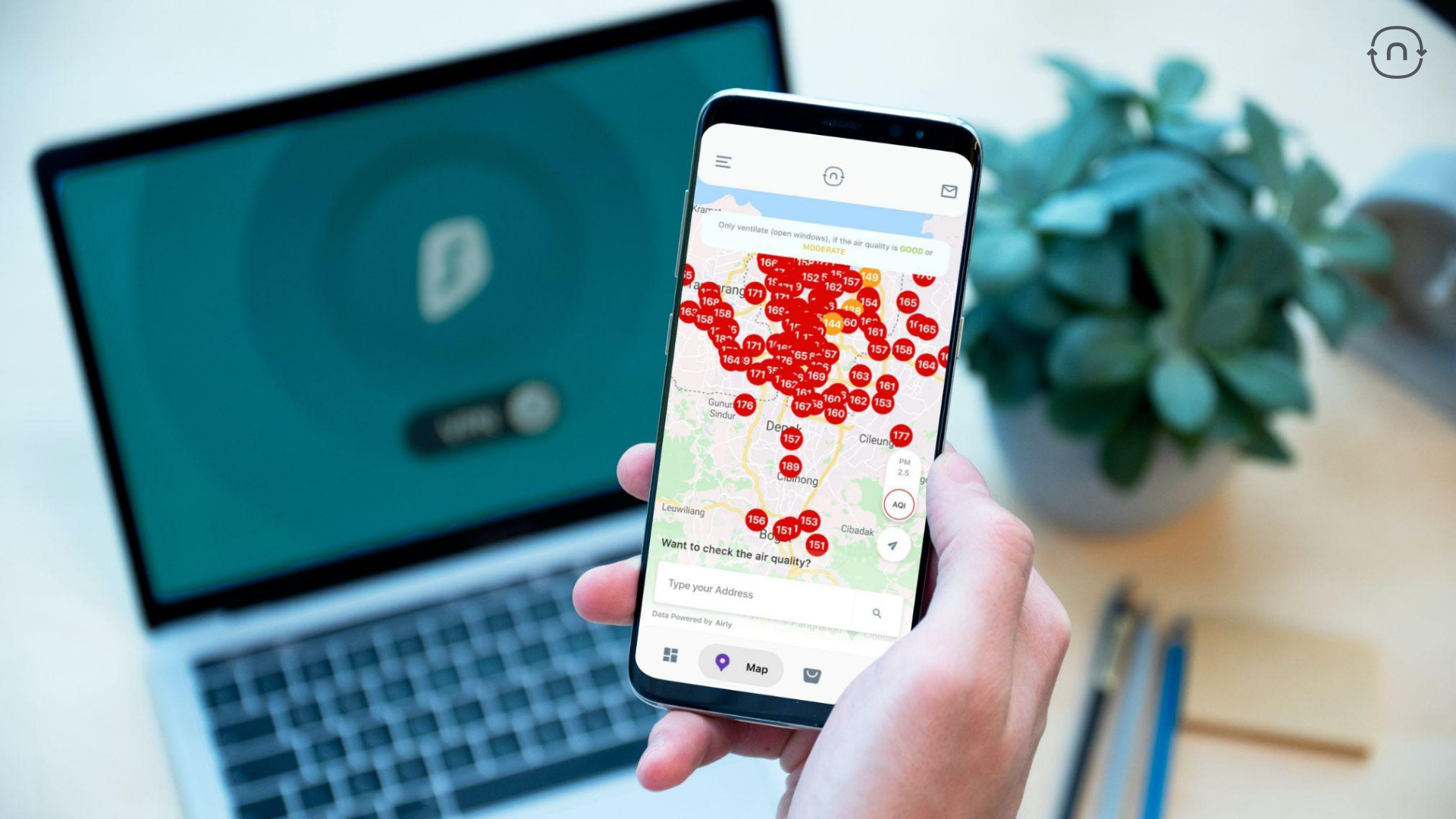
# Air pollution is not just a Jakarta problem, it's an issue in all urban areas around Indonesia.

This is data from July 2022 from the Nafas network. It is very visible here that air pollution is also a problem in Bandung, Surabaya, and many other parts outside of Jakarta




This is one of the reasons we started Nafas…

# Nafas: Indonesia’s Largest Air Quality Ecosystem

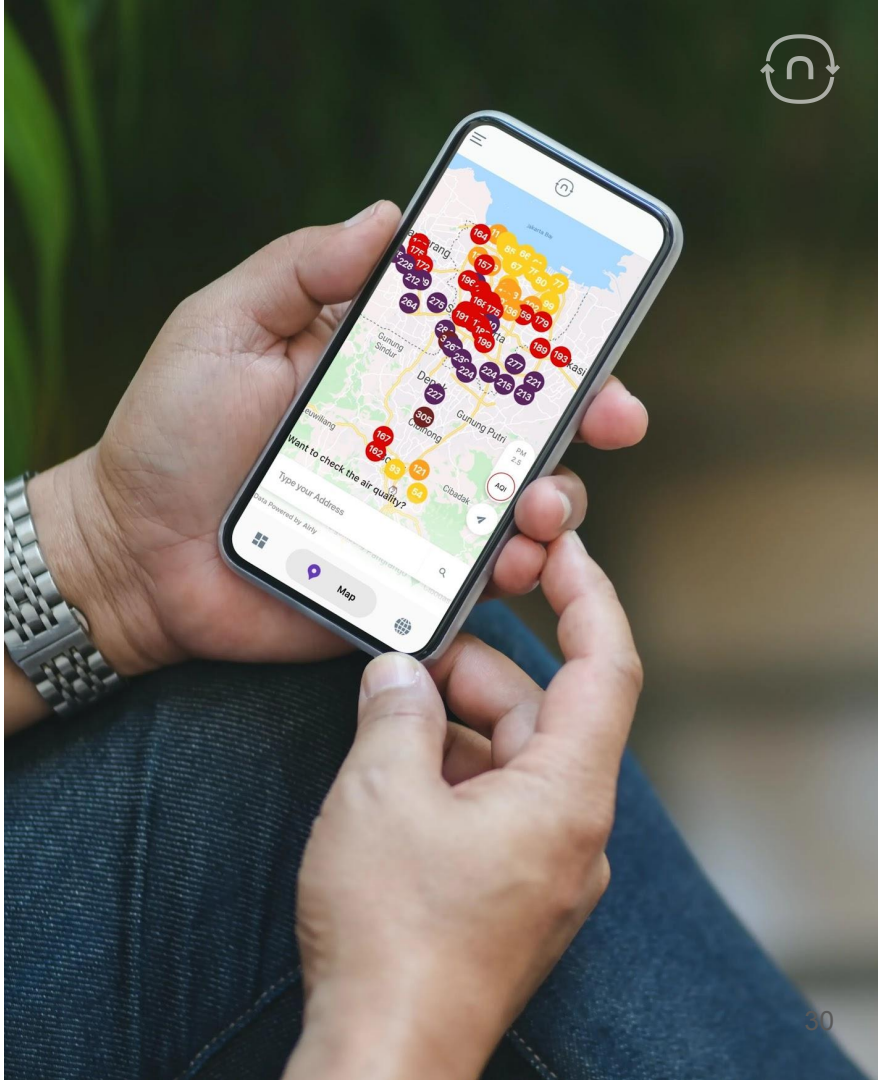

Only ventilate (open windows), if the air quality is GOOD or MODERATE
Gunung Sindur
Depok
Cileungsi
Cibinong
Leuwiliang
Cibadak
PM 2.5
AQI
Want to check the air quality?
Type your Address
Data Powered by Airly
Map

# **Nafas** makes air quality data available for everyone

**Bringing hyperlocal air quality data** to citizens in big cities in Indonesia and raising awareness about air pollution.

Citizens can access data from more than 170 locations via Android or iOS apps.

The app provides **practical recommendations for managing an outdoor lifestyle** in a polluted environment.

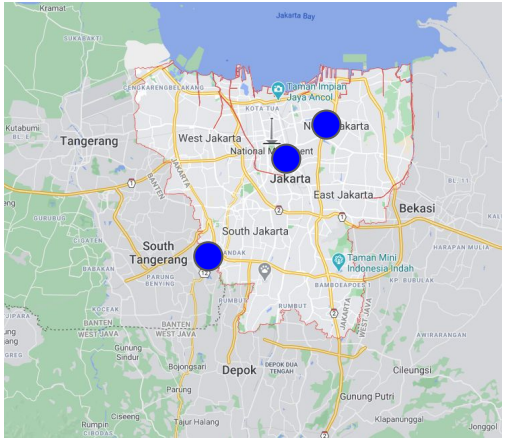


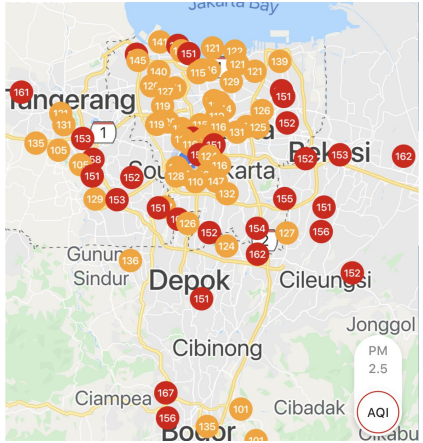
# Nafas was designed to address Sustainable Development Goals from the UN, particularly SDGs 3 and 11.

Ensure healthy lives and promote well-being for all at all ages

Make cities and human settlements inclusive, safe, resilient and sustainable

# Before, access to reliable air quality data was difficult and hyperlocal data was not available




## Before (Early 2020)

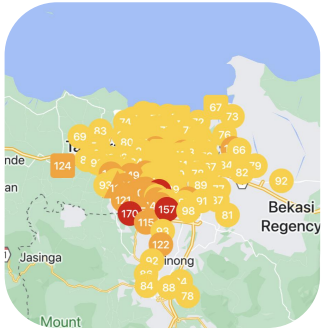
**3** Government Stations
**2** US Embassy Stations
**8-10** Crowdsourced

## After (Mid-2022)

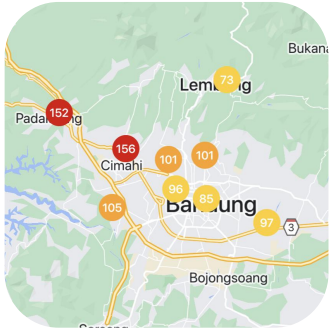
**>180** Stations in Jabodetabek, Bandung, DI Yogyakarta, Surabaya, Malang, Semarang, Lampung, and Bali.
**100%** ground based sensors

# Today, Nafas Has the Largest Outdoor Air Quality Network in Indonesia

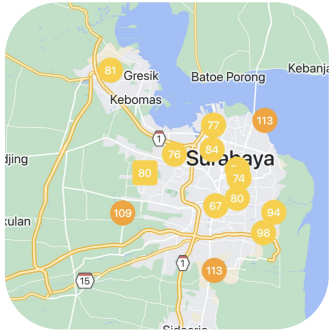
Jabodetabek



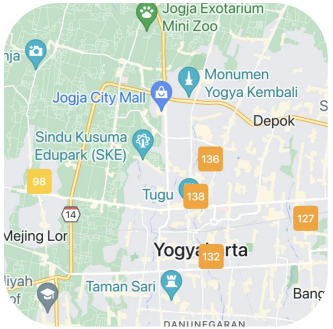

Bandung



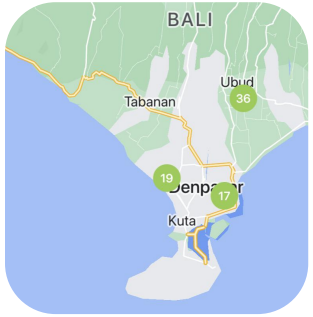

Surabaya




DI Yogyakarta




Bali




Semarang

Malang

Lampung

Belitung

**Current Network:**

**180+** Sensor Locations in **15** Cities

©2022 Nafas, All rights reserved

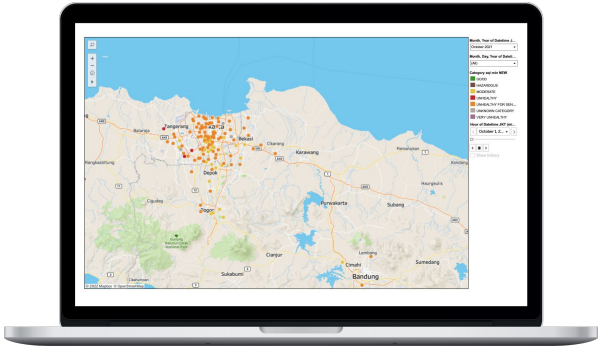
# Nafas Conducts Analysis of Air Quality Data In Ways Never Before Seen in Indonesia

Individual Location Analysis

24 Hour Averages

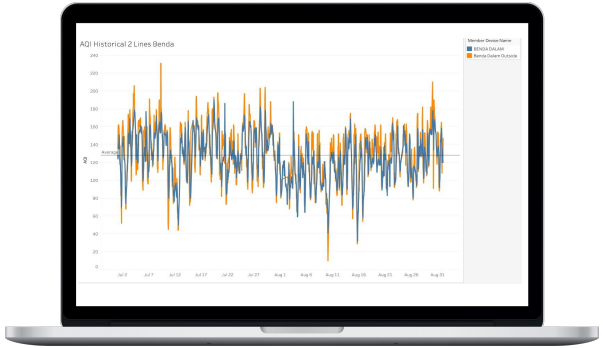
Regional Differentiation

Transboundary Pollution Analysis



Impact of Atmosphere

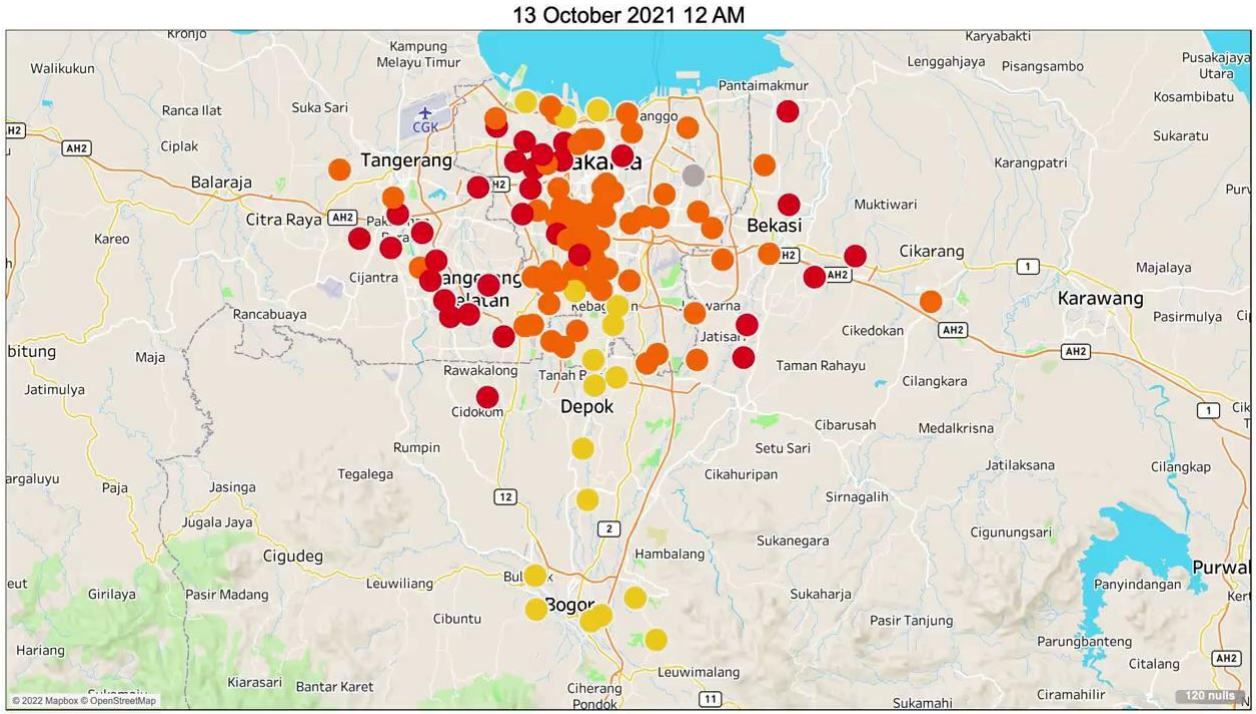
Comparison of Indoor vs Outdoor Pollution




©2022 Nafas, All rights reserved

Source: Nafas internal dashboard

# Data Example: Transboundary Pollution Analysis



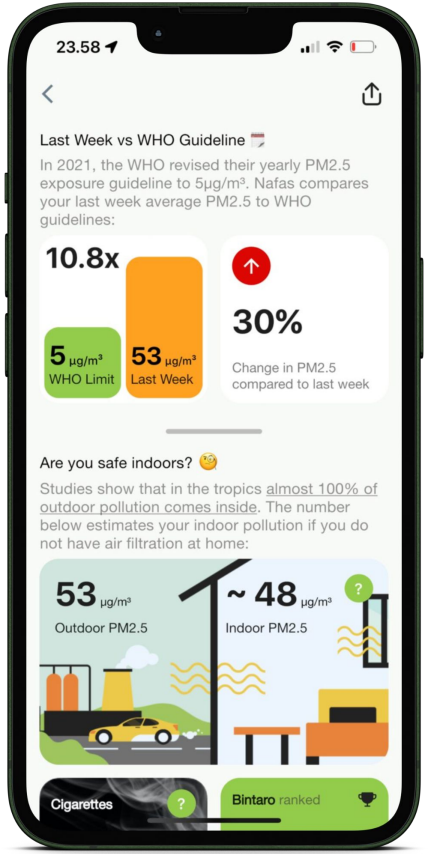

The density of Nafas network enables precise analysis of movement of pollution within different parts of each city.

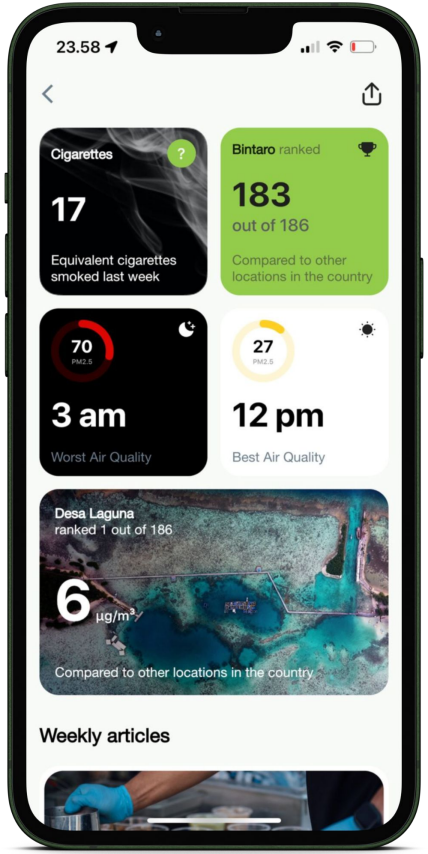
In this example you can see how air pollution travels across Jabodetabek.

©2022 Nafas, All rights reserved

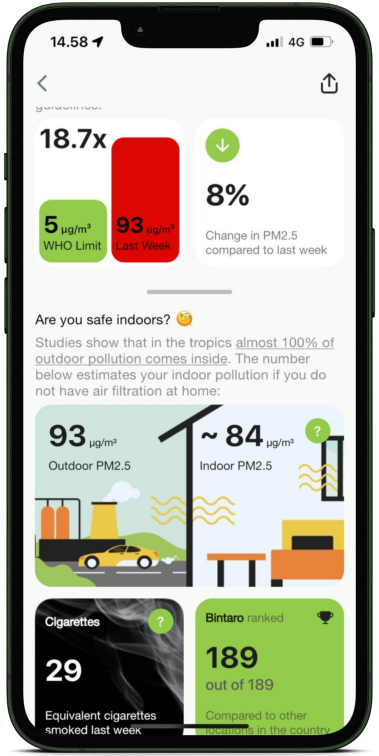
Source: Nafas internal dashboard

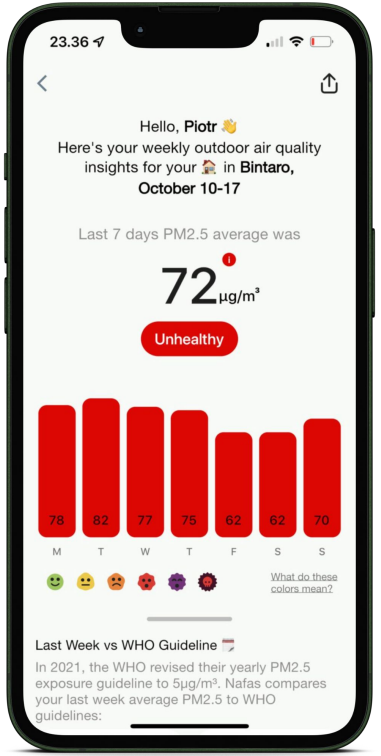
# Nafas Insights provides additional analytics for app users on a weekly basis



# Nafas Insights: Bintaro showcasing extremely poor air quality in Sept-Oct





Only ventilate (open windows), if the air quality is GOOD or MODERATE
Jl. Tegar Berima
162
PM 2.5
AQI
Last Updated 14:40, Jul 21 2021
Cibinong
Unhealthy
26 Followers
162
AQI
78
PM2.5
Do not ventilate, use purifiers indoors
Sponsored by nafas Indonesia
Map

# Some of the key features of the Nafas App

# Nafas: A Short Overview of Hyperlocal Data

# Nafas follows the US Environmental Protection Agency standard for air quality, highlighted in the scale below

It's simple, just remember the colors.

Green is Good
Yellow Sometimes

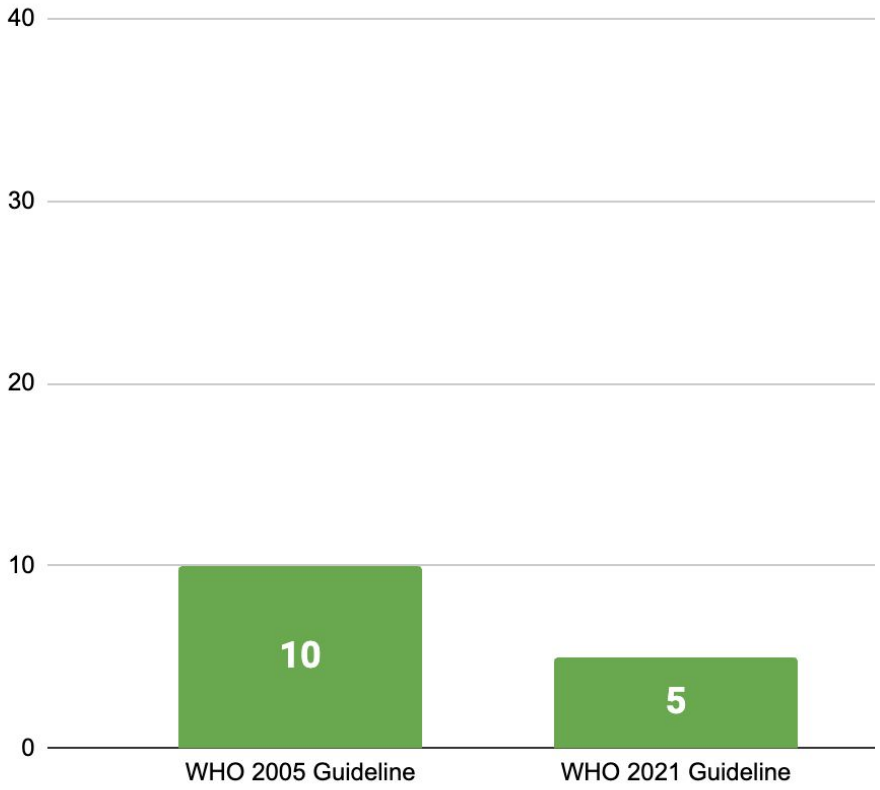
Orange is not Good
Red is Bad

Purple & Brown is Terrible

| PM2.5 | AQI | Deskripsi |
|---|---|---|
| 0-12.0 | 0-50 | Baik |
| 12.1-35.0 | 51-100 | Moderat |
| 35.1-55.0 | 101-150 | Tidak Sehat Bagi Kelompok Sensitif |
| 55.1-150.0 | 151-200 | Tidak Sehat |
| 150.1-250.0 | 201-300 | Sangat Tidak Sehat |
| >250.0 | 301-500 | Beracun |

©2022 Nafas, All rights reserved

# Air Pollution Yearly Exposure Guidelines

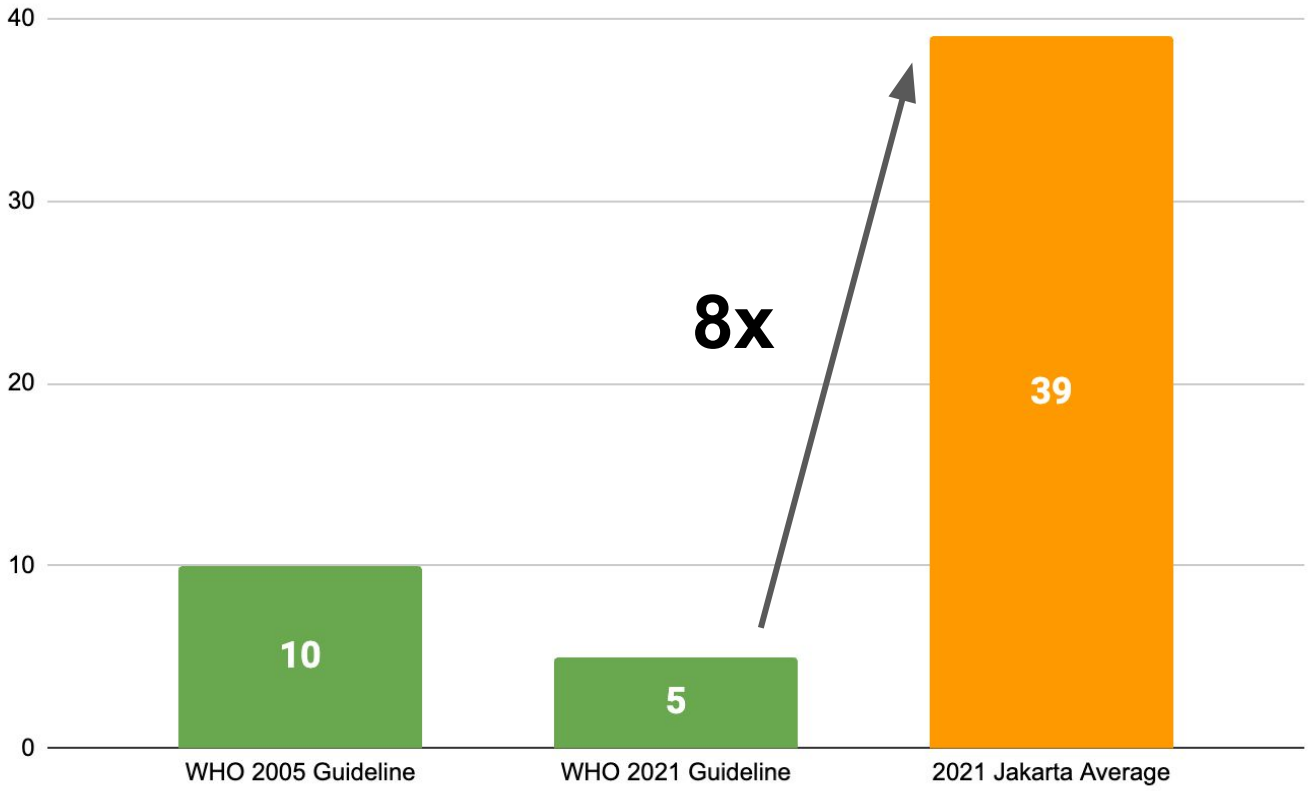



You remember this one?

The WHO that was revised in 2021?

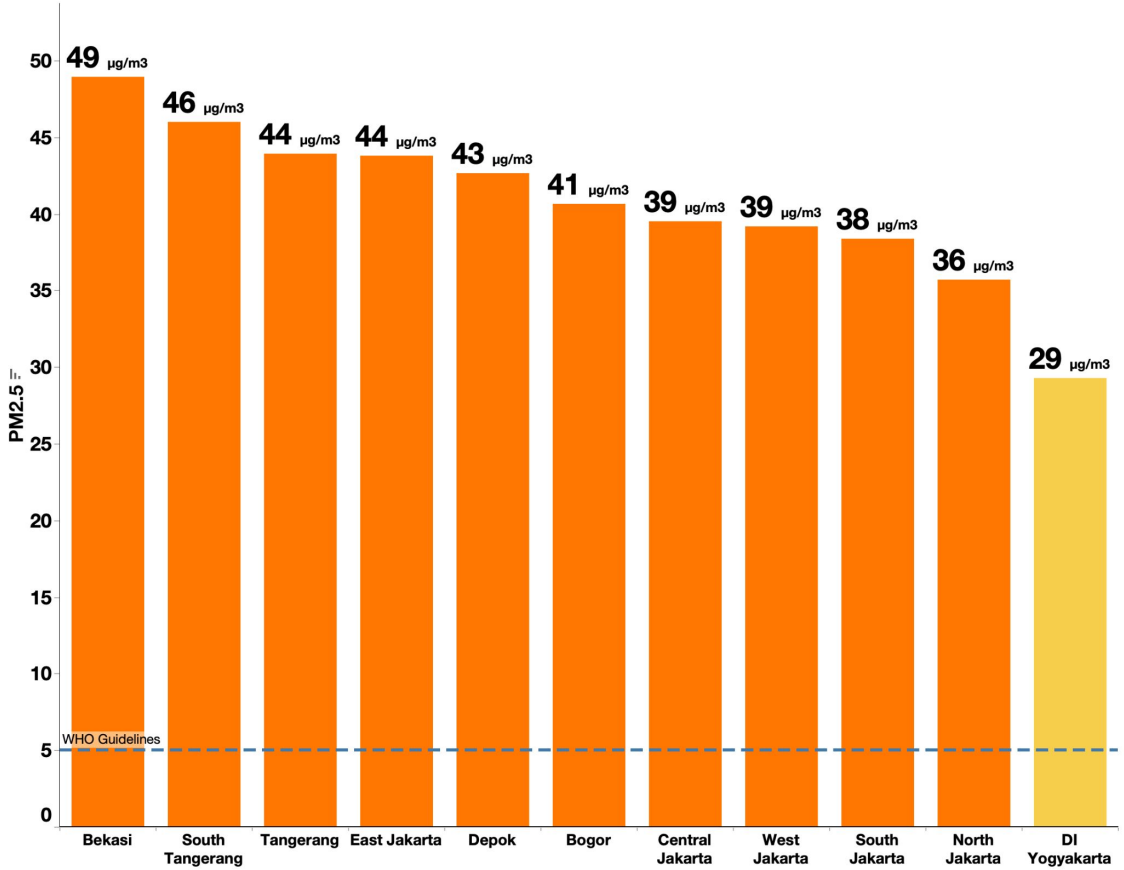
Let's see how that compares with DKI Jakarta average for 2021.

# PM2.5 Yearly Exposure Guidelines




The average PM2.5 level in DKI Jakarta in 2021 was 39 ug/m3, almost 8x higher than the guideline.

# 2021 - Yearly Average PM2.5 from Nafas sensor network

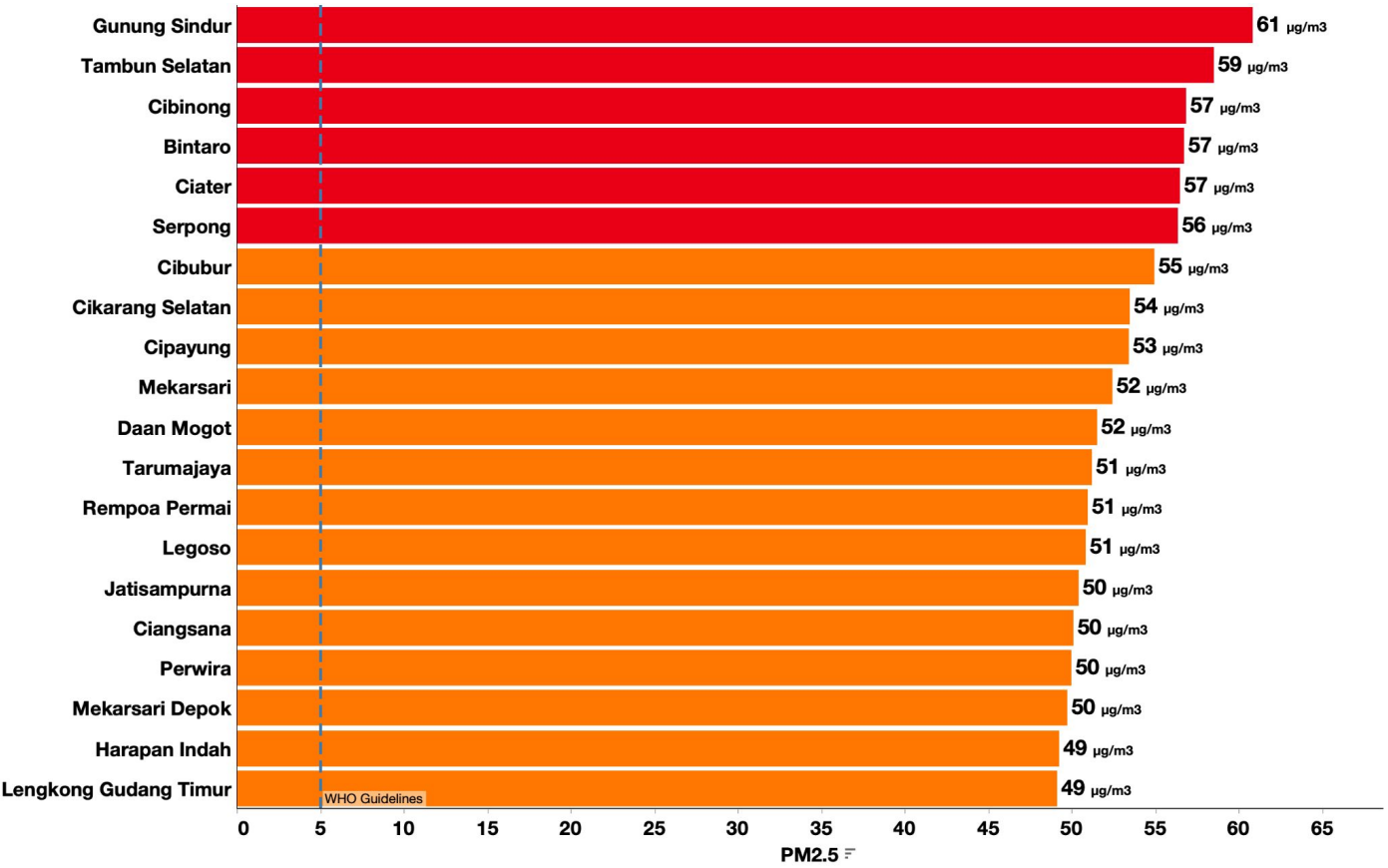



Looking at individual regions, even with DKI Jakarta, the average 2021 yearly PM2.5 levels ranged from 29 ug/m3 to 49 ug/m3.

This means that air pollution in these areas was 6-10 times higher than WHO guidelines.

©2022 Nafas, All rights reserved

# 2021 - Top 20 Worst Yearly PM2.5 Averages

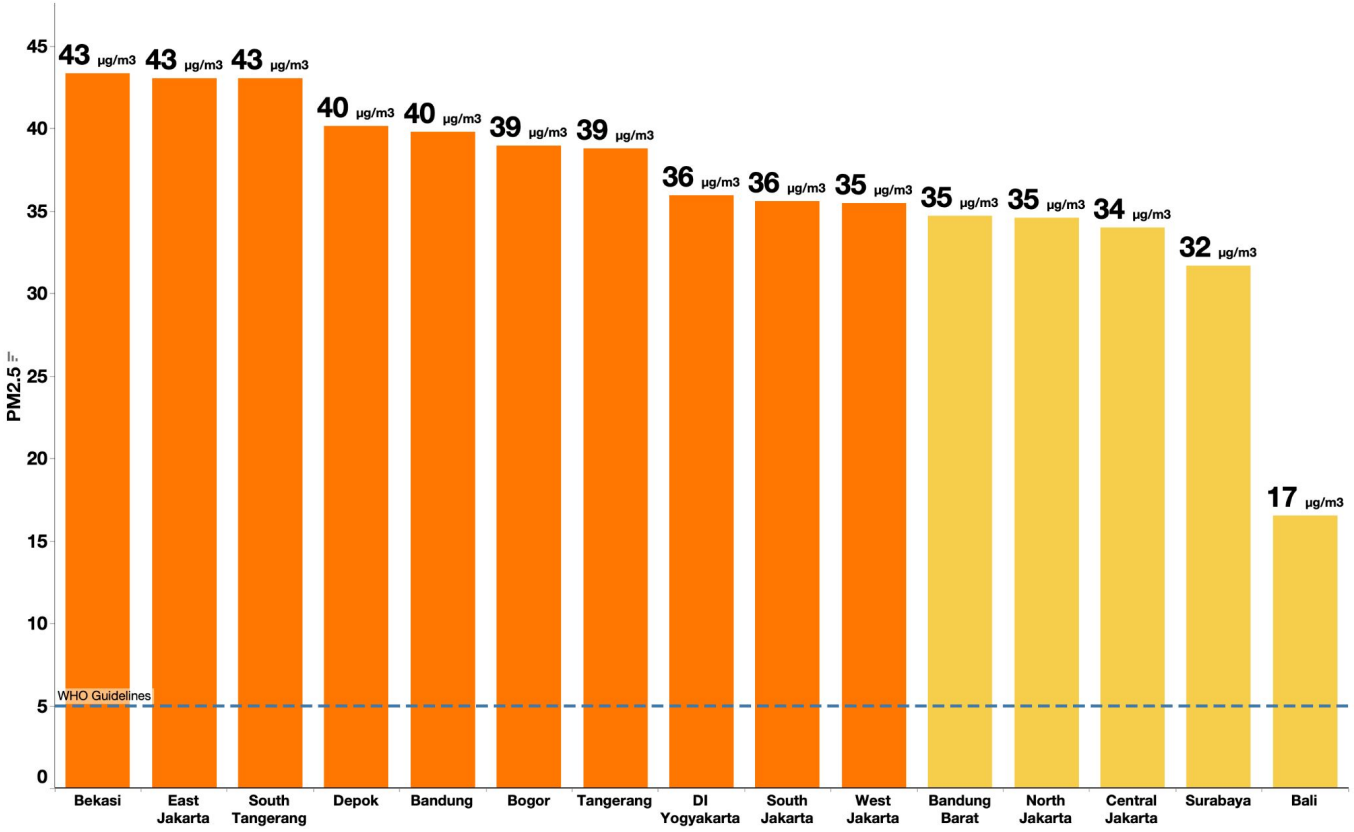



Looking at individual sensors (not on a region level) we can see that there is even more variation.

In some areas of Tangerang Selatan and Depok, yearly PM2.5 levels were 11x or 12x higher than WHO guidelines.

©2022 Nafas, All rights reserved

# 2022 YTD - Average PM2.5 from Nafas Sensor Network



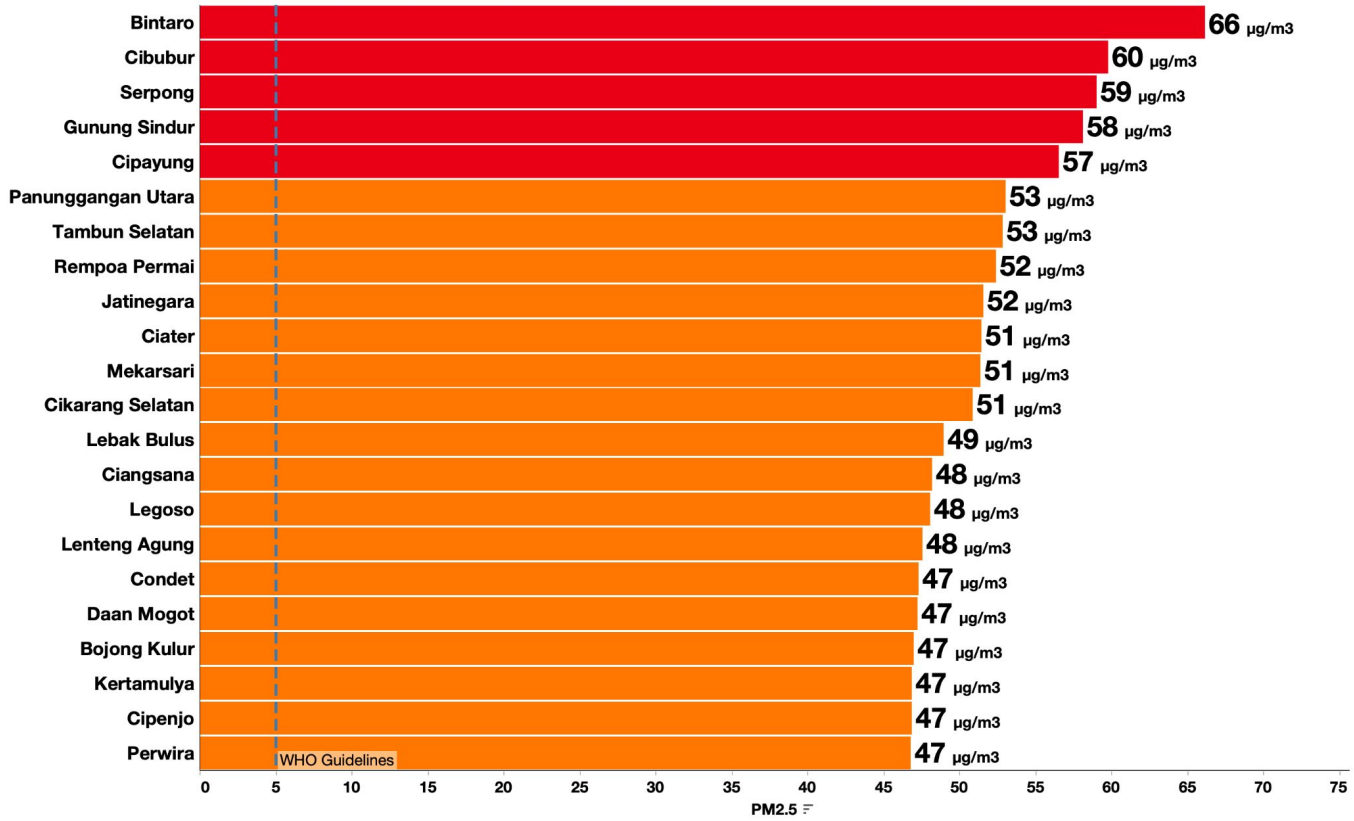

Year To Date in 2022, it seems that things may have improved slightly, on average.

However, looking at data from a regional basis is also a little bit deceiving.

Let's look at the top 20 worst in 2022 so far.

©2022 Nafas, All rights reserved

# 2022 YTD - Top 20 Worst YTD PM2.5 Averages



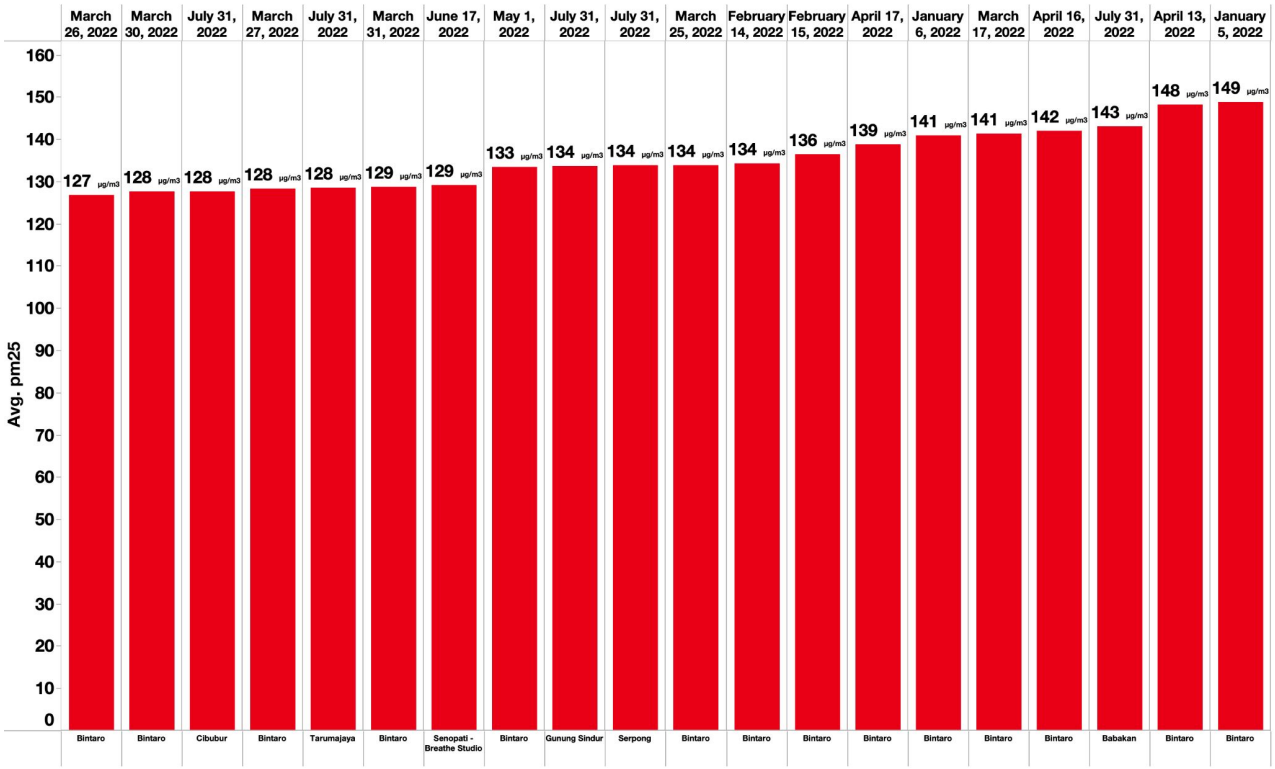

Year To Date in 2022, it seems that things may have improved slightly, on average.

However, looking at data from a regional basis is also a little bit deceiving.

Let's look at the top 20 worst in 2022 so far.

©2022 Nafas, All rights reserved

# 2022 YTD - Worst PM2.5 Daily Averages Recorded




As you can see here, we experienced days where the daily average PM2.5 reached almost 150 ug/m3.

A large number of these days were in the Bintaro area.

©2022 Nafas, All rights reserved

# Pollution can be both good & bad in a single month

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 AM | 73 | 120 | 78 | 72 | 53 | 8 | 26 | 49 | 101 | 14 | 60 | 15 | 65 | 98 | 47 | 13 | 31 | 43 | 65 | 62 | 47 | 53 | 38 | 33 | 30 | 17 | 21 | 12 |
| 1 AM | 69 | 107 | 85 | 39 | 52 | 8 | 28 | 42 | 91 | 11 | 66 | 17 | 66 | 100 | 49 | 12 | 30 | 49 | 65 | 61 | 26 | 56 | 36 | 13 | 37 | 18 | 18 | 10 |
| 2 AM | 62 | 85 | 82 | 25 | 44 | 10 | 29 | 44 | 82 | 6 | 65 | 18 | 70 | 94 | 52 | 11 | 32 | 52 | 64 | 66 | 16 | 40 | 40 | 6 | 37 | 18 | 16 | 7 |
| 3 AM | 58 | 59 | 82 | 16 | 31 | 10 | 25 | 50 | 73 | 7 | 61 | 17 | 68 | 90 | 59 | 9 | 33 | 49 | 67 | 66 | 17 | 10 | 43 | 5 | 31 | 21 | 10 | 8 |
| 4 AM | 53 | 54 | 80 | 19 | 26 | 8 | 22 | 51 | 66 | 3 | 65 | 13 | 68 | 86 | 60 | 12 | 34 | 44 | 63 | 65 | 18 | 11 | 27 | 4 | 29 | 24 | 7 | 8 |
| 5 AM | 53 | 72 | 64 | 25 | 25 | 8 | 23 | 51 | 61 | 3 | 75 | 15 | 78 | 83 | 61 | 16 | 35 | 41 | 52 | 65 | 18 | 15 | 15 | 5 | 31 | 30 | 9 | 10 |
| 6 AM | 56 | 85 | 49 | 31 | 22 | 12 | 28 | 48 | 56 | 5 | 76 | 21 | 79 | 77 | 67 | 24 | 38 | 43 | 48 | 68 | 23 | 22 | 20 | 9 | 33 | 36 | 14 | 13 |
| 7 AM | 61 | 86 | 46 | 34 | 23 | 19 | 33 | 53 | 51 | 8 | 66 | 29 | 72 | 67 | 79 | 31 | 42 | 50 | 52 | 74 | 30 | 27 | 28 | 13 | 20 | 44 | 15 | 12 |
| 8 AM | 46 | 62 | 39 | 31 | 21 | 14 | 33 | 54 | 27 | 8 | 54 | 36 | 61 | 57 | 87 | 34 | 41 | 63 | 60 | 55 | 34 | 32 | 26 | 10 | 9 | 46 | 12 | 13 |
| 9 AM | 33 | 34 | 35 | 31 | 16 | 11 | 34 | 50 | 24 | 8 | 35 | 37 | 42 | 22 | 74 | 33 | 30 | 73 | 50 | 34 | 32 | 31 | 18 | 9 | 10 | 30 | 7 | 15 |
| 10 AM | 33 | 31 | 33 | 27 | 21 | 9 | 26 | 56 | 24 | 7 | 33 | 38 | 36 | 13 | 58 | 33 | 28 | 77 | 45 | 31 | 24 | 25 | 16 | 12 | 8 | 23 | 9 | 11 |
| 11 AM | 32 | 26 | 31 | 31 | 25 | 8 | 15 | 48 | 27 | 8 | 33 | 43 | 44 | 16 | 38 | 36 | 28 | 64 | 56 | 35 | 24 | 17 | 16 | 10 | 10 | 17 | 11 | 11 |
| 12 PM | 34 | 20 | 27 | 35 | 24 | 8 | 12 | 43 | 25 | 11 | 33 | 48 | 48 | 19 | 35 | 32 | 34 | 49 | 55 | 40 | 24 | 12 | 16 | 9 | 7 | 12 | 9 | 14 |
| 1 PM | 36 | 17 | 24 | 26 | 14 | 5 | 11 | 37 | 26 | 8 | 32 | 44 | 50 | 16 | 31 | 33 | 34 | 44 | 38 | 29 | 31 | 13 | 14 | 9 | 4 | 10 | 5 | 10 |
| 2 PM | 33 | 28 | 28 | 22 | 9 | 5 | 11 | 34 | 28 | 8 | 31 | 40 | 43 | 14 | 33 | 41 | 34 | 48 | 36 | 28 | 32 | 24 | 15 | 9 | 6 | 5 | 5 | 7 |
| 3 PM | 29 | 30 | 21 | 27 | 16 | 5 | 13 | 41 | 26 | 12 | 32 | 44 | 41 | 14 | 43 | 44 | 38 | 45 | 37 | 29 | 32 | 29 | 17 | 9 | 10 | 10 | 7 | 8 |
| 4 PM | 25 | 30 | 20 | 27 | 24 | 11 | 13 | 46 | 21 | 14 | 33 | 47 | 43 | 17 | 28 | 46 | 35 | 51 | 34 | 22 | 28 | 22 | 18 | 12 | 16 | 16 | 8 | 10 |
| 5 PM | 30 | 27 | 25 | 32 | 20 | 20 | 16 | 49 | 22 | 17 | 25 | 48 | 49 | 26 | 27 | 44 | 36 | 48 | 33 | 29 | 32 | 30 | 23 | 16 | 20 | 20 | 11 | 15 |
| 6 PM | 43 | 25 | 32 | 30 | 20 | 28 | 22 | 58 | 24 | 24 | 24 | 46 | 47 | 40 | 37 | 38 | 38 | 48 | 39 | 39 | 33 | 34 | 38 | 20 | 22 | 28 | 17 | 20 |
| 7 PM | 59 | 24 | 59 | 27 | 24 | 39 | 25 | 74 | 20 | 33 | 26 | 48 | 48 | 59 | 46 | 26 | 35 | 48 | 47 | 53 | 42 | 37 | 49 | 26 | 24 | 31 | 21 | 21 |
| 8 PM | 75 | 29 | 73 | 33 | 26 | 48 | 25 | 89 | 8 | 42 | 23 | 45 | 57 | 70 | 54 | 18 | 38 | 56 | 58 | 61 | 58 | 40 | 71 | 26 | 24 | 23 | 20 | 19 |
| 9 PM | 101 | 39 | 67 | 36 | 20 | 37 | 28 | 93 | 13 | 50 | 22 | 43 | 64 | 67 | 37 | 24 | 41 | 62 | 65 | 73 | 51 | 39 | 48 | 30 | 23 | 21 | 15 | 18 |
| 10 PM | 125 | 54 | 68 | 41 | 13 | 35 | 40 | 104 | 16 | 48 | 19 | 44 | 76 | 62 | 20 | 27 | 43 | 65 | 68 | 74 | 49 | 37 | 46 | 30 | 20 | 25 | 13 | 18 |
| 11 PM | 124 | 64 | 76 | 46 | 10 | 29 | 49 | 113 | 14 | 51 | 16 | 52 | 88 | 53 | 17 | 28 | 44 | 62 | 67 | 64 | 52 | 39 | 39 | 29 | 17 | 27 | 13 | 18 |

Sometimes within an individual month it can be both really good and really bad.

This is data from the Depok region in February 2022, with hourly PM2.5 levels for each day of the month.

©2022 Nafas, All rights reserved

# And some months are worse than others

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 AM | 45 | 98 | 93 | 49 | 81 | 80 | 87 | 45 | 20 | 38 | 66 | 67 | 40 | 58 | 35 | 30 | 54 | 123 | 54 | 78 | 49 | 101 | 29 | 25 | 35 | 60 | 51 | 99 | 40 | 61 | 95 |
| 1 AM | 44 | 93 | 93 | 43 | 96 | 87 | 102 | 29 | 17 | 39 | 64 | 57 | 43 | 55 | 36 | 26 | 57 | 154 | 49 | 78 | 49 | 73 | 32 | 25 | 32 | 60 | 53 | 91 | 34 | 62 | 89 |
| 2 AM | 46 | 99 | 97 | 39 | 93 | 81 | 118 | 24 | 14 | 31 | 54 | 62 | 45 | 50 | 37 | 19 | 67 | 133 | 46 | 78 | 56 | 42 | 35 | 28 | 33 | 51 | 49 | 83 | 33 | 61 | 81 |
| 3 AM | 46 | 86 | 98 | 34 | 75 | 71 | 109 | 20 | 13 | 28 | 46 | 86 | 47 | 45 | 37 | 19 | 69 | 101 | 44 | 78 | 58 | 35 | 35 | 31 | 33 | 40 | 54 | 94 | 32 | 56 | 77 |
| 4 AM | 46 | 59 | 97 | 29 | 57 | 48 | 108 | 16 | 19 | 27 | 34 | 93 | 45 | 46 | 40 | 17 | 61 | 93 | 48 | 74 | 64 | 33 | 37 | 33 | 30 | 36 | 59 | 107 | 32 | 54 | 77 |
| 5 AM | 49 | 47 | 92 | 27 | 51 | 33 | 104 | 17 | 22 | 26 | 29 | 88 | 44 | 48 | 44 | 17 | 48 | 94 | 51 | 71 | 65 | 34 | 41 | 32 | 27 | 34 | 61 | 97 | 39 | 51 | 83 |
| 6 AM | 53 | 54 | 78 | 25 | 52 | 32 | 96 | 25 | 20 | 25 | 30 | 81 | 49 | 51 | 50 | 17 | 40 | 95 | 60 | 78 | 57 | 40 | 48 | 33 | 28 | 39 | 64 | 84 | 57 | 55 | 95 |
| 7 AM | 57 | 65 | 72 | 28 | 59 | 43 | 83 | 35 | 42 | 26 | 41 | 90 | 65 | 56 | 58 | 18 | 42 | 97 | 70 | 88 | 51 | 43 | 59 | 39 | 29 | 55 | 72 | 87 | 70 | 66 | 99 |
| 8 AM | 60 | 68 | 75 | 29 | 59 | 59 | 84 | 27 | 54 | 28 | 53 | 101 | 84 | 47 | 49 | 16 | 44 | 82 | 60 | 75 | 42 | 47 | 59 | 39 | 33 | 68 | 69 | 63 | 52 | 57 | 87 |
| 9 AM | 45 | 61 | 73 | 25 | 45 | 68 | 58 | 20 | 38 | 27 | 57 | | 85 | 36 | 36 | 16 | 50 | 53 | 56 | 59 | 46 | 51 | 37 | 37 | 39 | 60 | 60 | 42 | 43 | 50 | 77 |
| 10 AM | 37 | 54 | 66 | 22 | 39 | 79 | 42 | 17 | 31 | 26 | 55 | 68 | 82 | 29 | 30 | 18 | 35 | 43 | 60 | 56 | 55 | 51 | 34 | 33 | 39 | 46 | 58 | 37 | 40 | 57 | 75 |
| 11 AM | 32 | 42 | 56 | 24 | 37 | 102 | 41 | 17 | 29 | 25 | 44 | 59 | 81 | 27 | 31 | 22 | 28 | 41 | 49 | 49 | 52 | 56 | 39 | 30 | 33 | 43 | 53 | 35 | 39 | 60 | 73 |
| 12 PM | 29 | 36 | 45 | 24 | 35 | 107 | 38 | 17 | 23 | 24 | 38 | 62 | 82 | 32 | 39 | 26 | 24 | 40 | 41 | 44 | 48 | 64 | 39 | 31 | 34 | 41 | 44 | 45 | 37 | 50 | 63 |
| 1 PM | 28 | 37 | 40 | 20 | 37 | 47 | 38 | 16 | 20 | 25 | 37 | 67 | 66 | 38 | 40 | 16 | 29 | 44 | 47 | 50 | 50 | 68 | 37 | 34 | 37 | 42 | 43 | 37 | 32 | 45 | 49 |
| 2 PM | 32 | 47 | 26 | 16 | 33 | 26 | 44 | 19 | 22 | 23 | 38 | 60 | 43 | 32 | 36 | 11 | 29 | 53 | 47 | 48 | 46 | 51 | 35 | 36 | 46 | 46 | 46 | 34 | 32 | 45 | 45 |
| 3 PM | 35 | 58 | 28 | 16 | 31 | 27 | 41 | 21 | 30 | 25 | 41 | 49 | 29 | 28 | 35 | 10 | 28 | 54 | 45 | 42 | 44 | 46 | 34 | 38 | 43 | 44 | 52 | 37 | 35 | 41 | 42 |
| 4 PM | 34 | 70 | 32 | 15 | 28 | 37 | 39 | 20 | 29 | 27 | 45 | 39 | 34 | 26 | 34 | 14 | 37 | 54 | 43 | 45 | 41 | 45 | 35 | 42 | 42 | 42 | 48 | 39 | 42 | 39 | 40 |
| 5 PM | 39 | 71 | 36 | 21 | 20 | 70 | 35 | 29 | 33 | 35 | 49 | 40 | 34 | 28 | 37 | 28 | 40 | 47 | 41 | 47 | 40 | 44 | 35 | 47 | 42 | 43 | 52 | 48 | 42 | 49 | 38 |
| 6 PM | 57 | 75 | 41 | 30 | 35 | 85 | 40 | 37 | 39 | 46 | 60 | 42 | 36 | 35 | 22 | 32 | 50 | 44 | 40 | 55 | 44 | 43 | 35 | 51 | 39 | 44 | 58 | 63 | 37 | 57 | 42 |
| 7 PM | 74 | 71 | 46 | 44 | 58 | 104 | 59 | 34 | 47 | 53 | 62 | 50 | 39 | 39 | 10 | 35 | 64 | 41 | 40 | 58 | 43 | 37 | 43 | 39 | 38 | 47 | 66 | 61 | 35 | 63 | 46 |
| 8 PM | 88 | 66 | 48 | 50 | 60 | 117 | 67 | 24 | 46 | 66 | 49 | 47 | 43 | 41 | 12 | 40 | 80 | 46 | 45 | 55 | 42 | 26 | 38 | 31 | 35 | 45 | 77 | 52 | 37 | 61 | 49 |
| 9 PM | 103 | 66 | 46 | 61 | 63 | 104 | 76 | 23 | 39 | 81 | 51 | 46 | 45 | 46 | 20 | 42 | 91 | 51 | 50 | 55 | 53 | 28 | 36 | 30 | 46 | 46 | 89 | 47 | 43 | 73 | 56 |
| 10 PM | 102 | 73 | 45 | 63 | 72 | 85 | 66 | 24 | 31 | 88 | 60 | 46 | 50 | 44 | 28 | 46 | 104 | 59 | 58 | 50 | 75 | 29 | 27 | 34 | 64 | 46 | 95 | 43 | 48 | 88 | 59 |
| 11 PM | 107 | 88 | 51 | 82 | 76 | 81 | 57 | 23 | 32 | 79 | 70 | 43 | 56 | 39 | 30 | 49 | 112 | 60 | 71 | 50 | 99 | 28 | 25 | 38 | 63 | 49 | 97 | 44 | 52 | 90 | 62 |

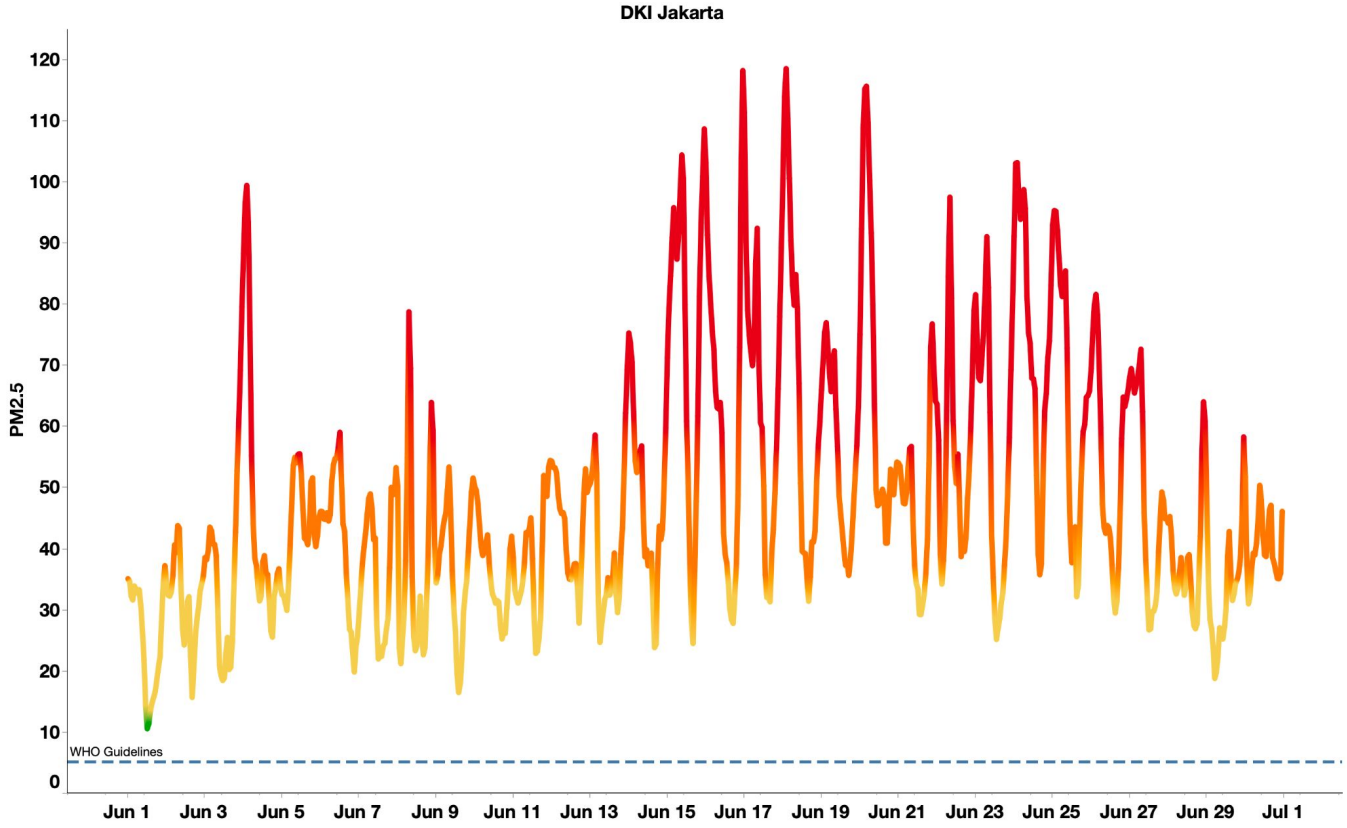
And here is the average for the Depok region in June 2022.

Not much green, in fact not even much yellow.

This month the air quality was particularly bad.

©2022 Nafas, All rights reserved

# Pollution also behaves differently from city to city…

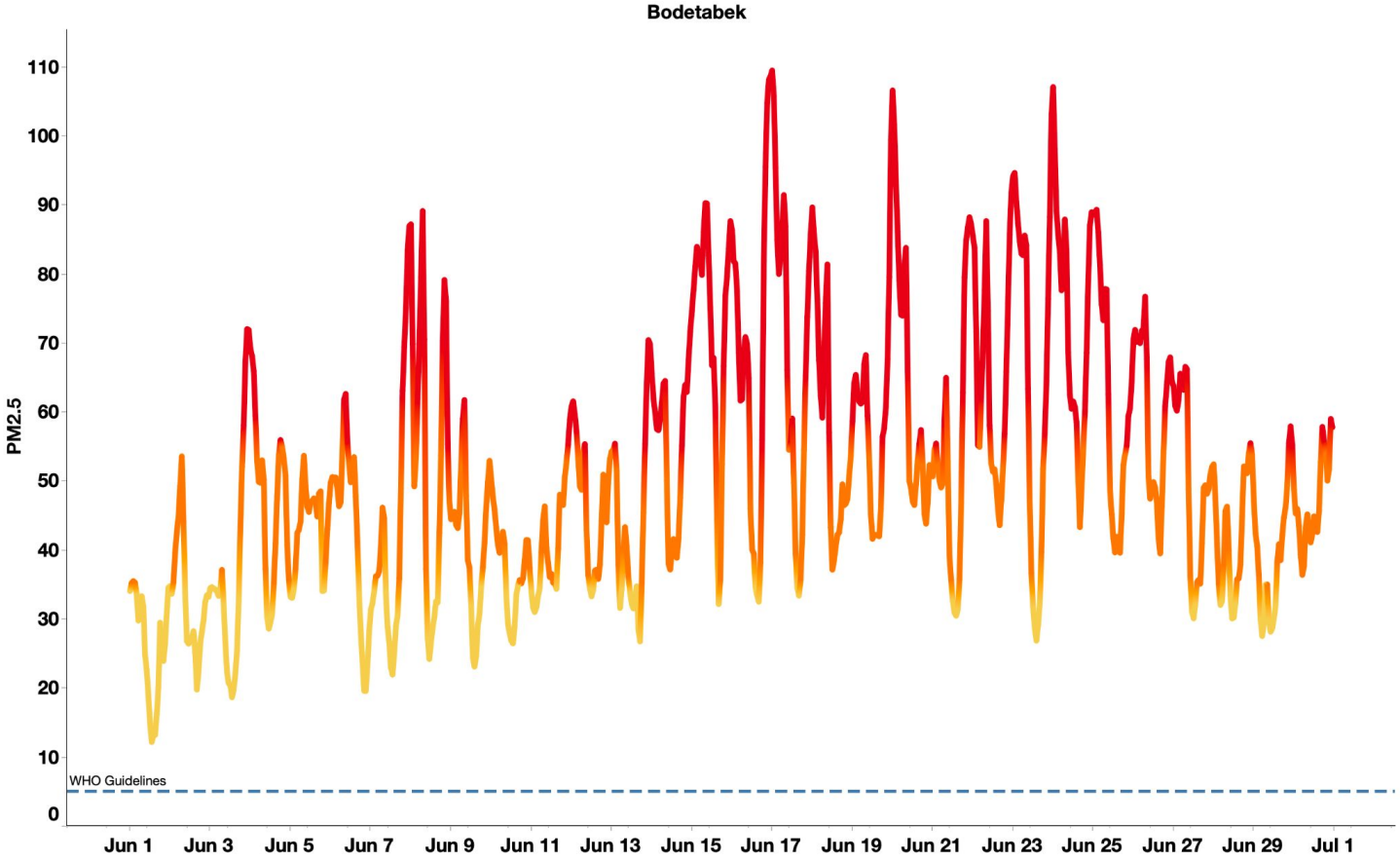



Here is the hourly PM2.5 levels from DKI Jakarta during the month of June 2022.

Far above the WHO guideline of 5 ug/m3.

©2022 Nafas, All rights reserved

# Pollution also behaves differently from city to city…

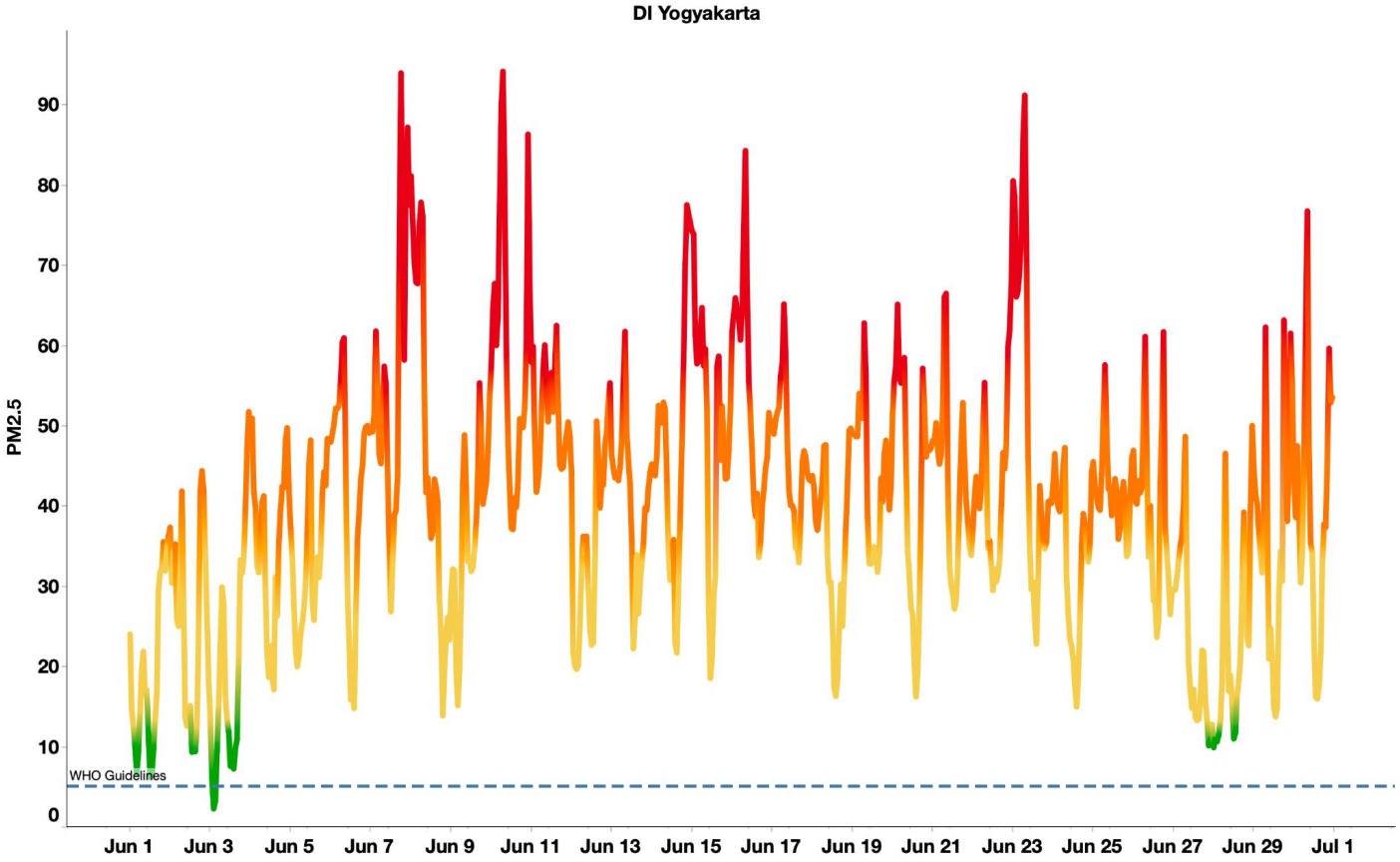



Here is the hourly PM2.5 levels from Bodetabek during the month of June 2022.

Trends are a bit more similar to DKI Jakarta.

©2022 Nafas, All rights reserved

# Pollution also behaves differently from city to city…

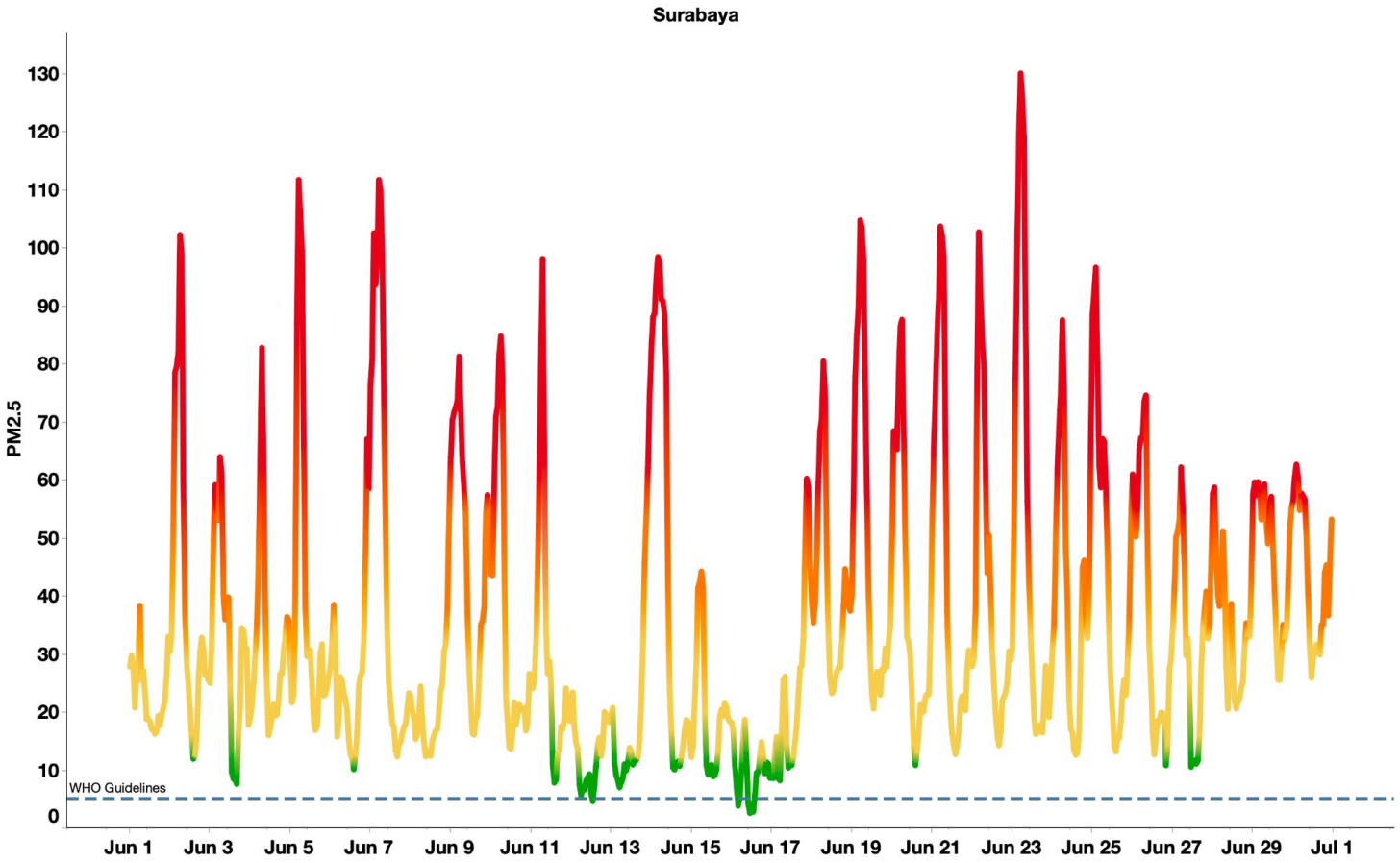



Here is the hourly PM2.5 levels from Yogyakarta during the month of June 2022.

Trends are quite different than DKI Jakarta.

©2022 Nafas, All rights reserved

# Pollution also behaves differently from city to city…

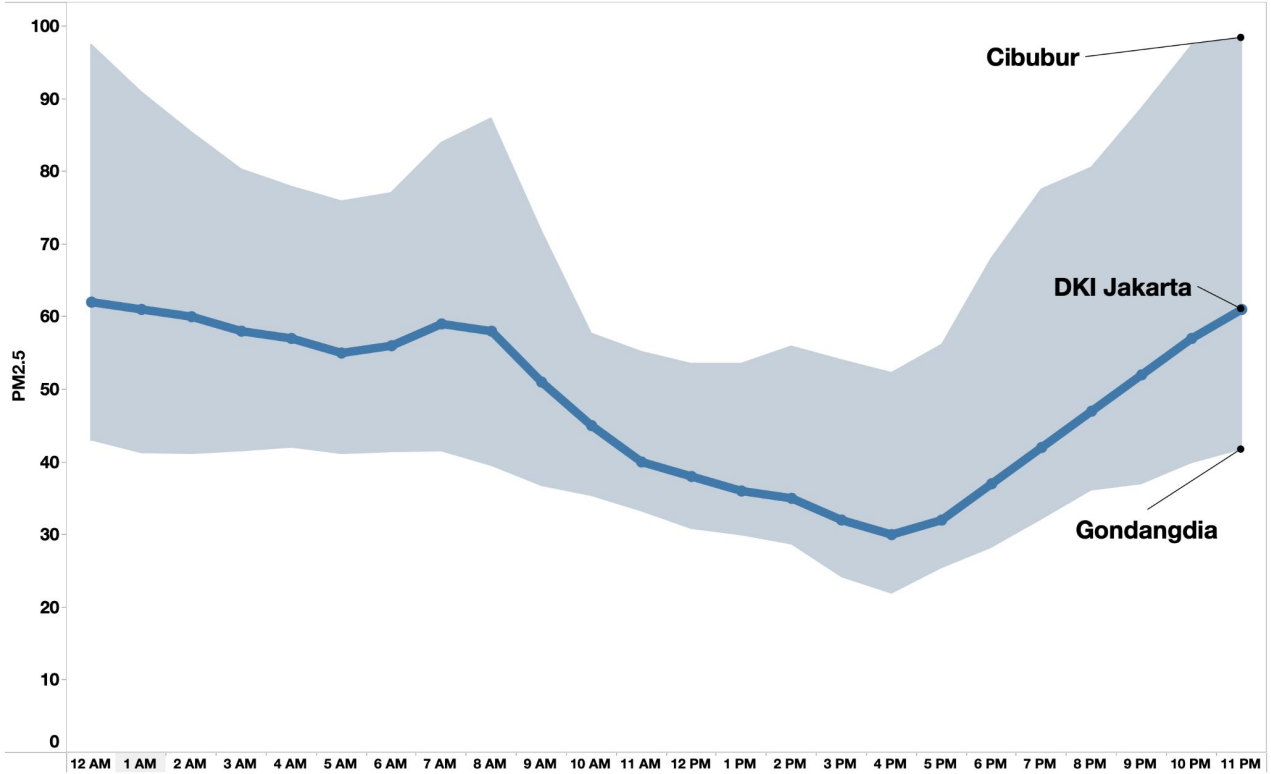



Here is the hourly PM2.5 levels from Surabaya during the month of June 2022.

Trends are quite different than DKI Jakarta.

©2022 Nafas, All rights reserved

# Within each region, we can see a huge range of air pollution - this highlights the importance of hyperlocal data

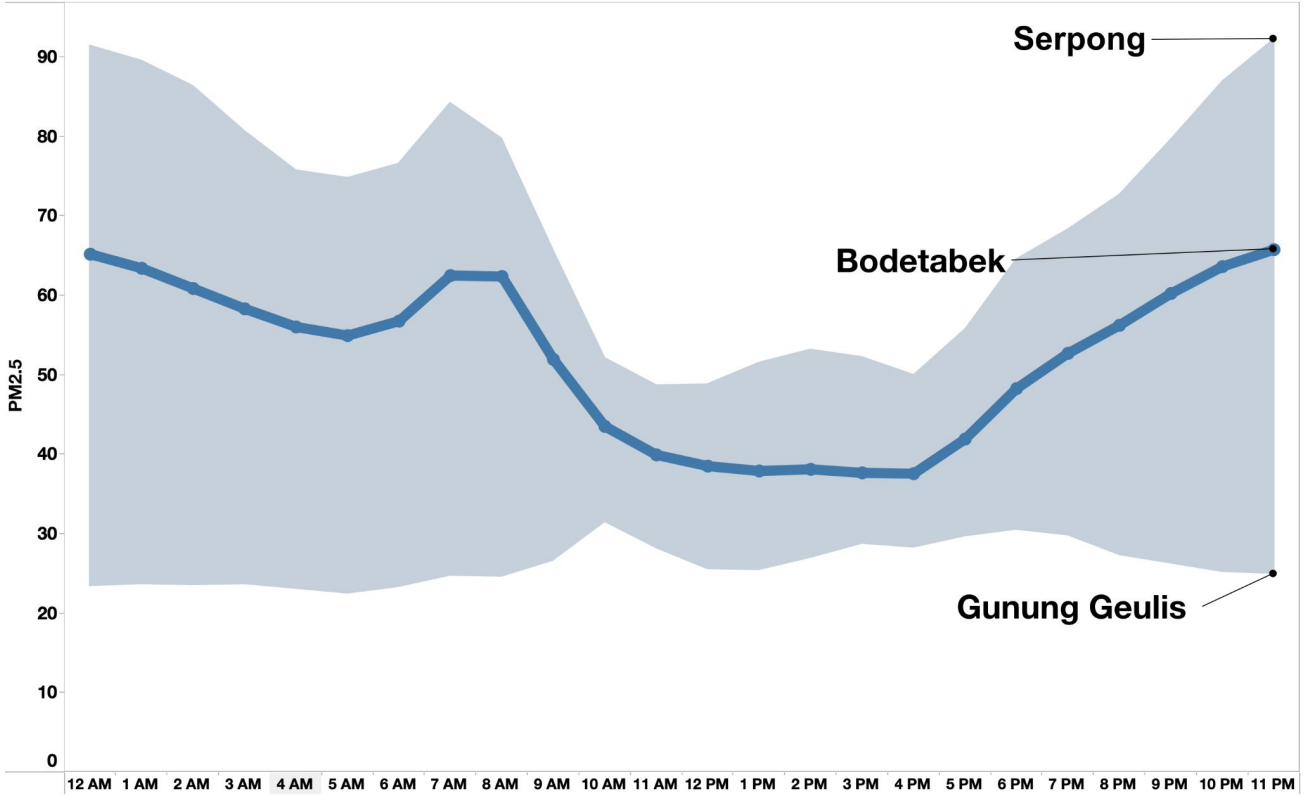



As you can see from the June 2022 PM2.5 averages across 24 hours, the range between the best and the worst location in DKI Jakarta is quite large.

At 11PM, Cibubur on average was hitting PM2.5 levels of close to 100, whereas Gondangdia was at around 40, more than 50% less.

©2022 Nafas, All rights reserved

# Within each region, we can see a huge range of air pollution - this highlights the importance of hyperlocal data

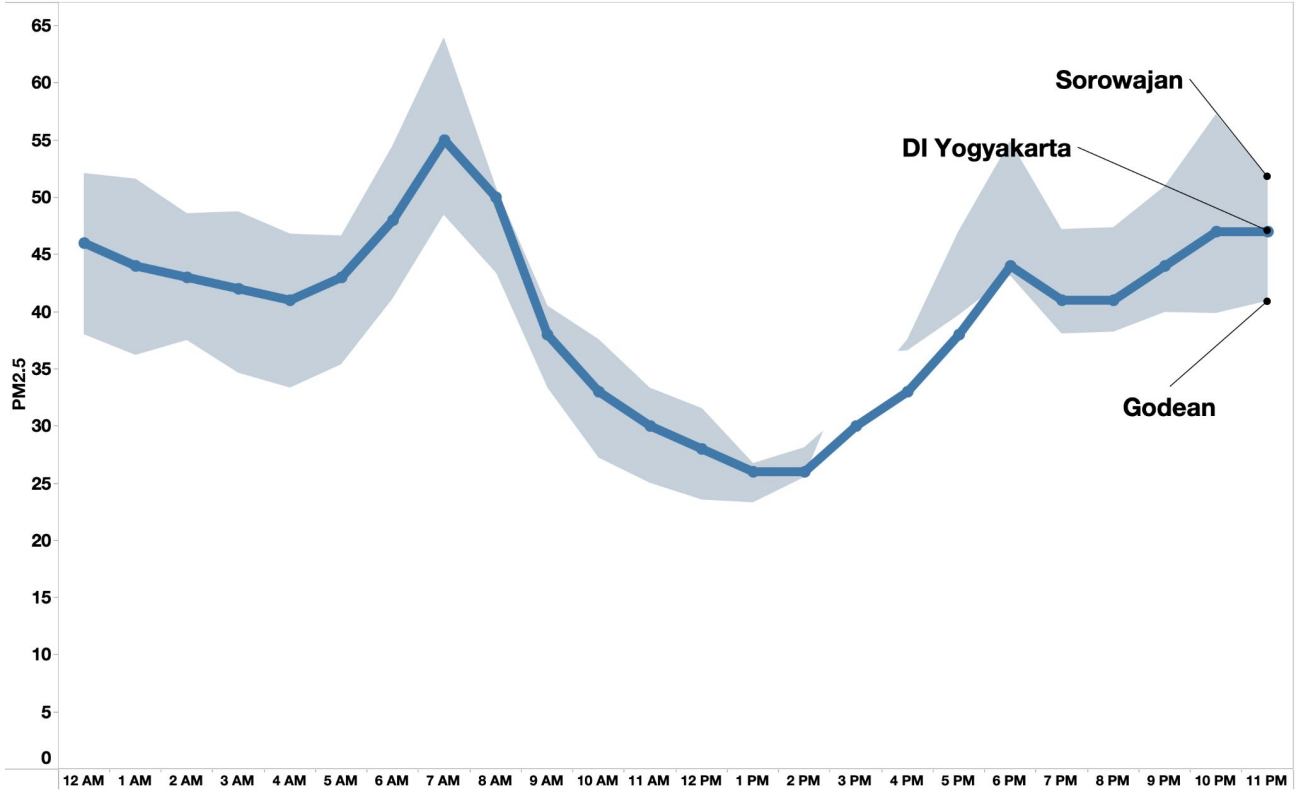



As you can see from the June 2022 PM2.5 averages across 24 hours, the range between the best and the worst location in Bodetabek is also quite large.

At 11PM, Serpong (TangSel) on average was hitting PM2.5 levels of close to 100, which is more than 3x higher than Gunung Geulis (Bogor) at the same time

©2022 Nafas, All rights reserved

# In some regions, the ranges between best and worst locations are not as large

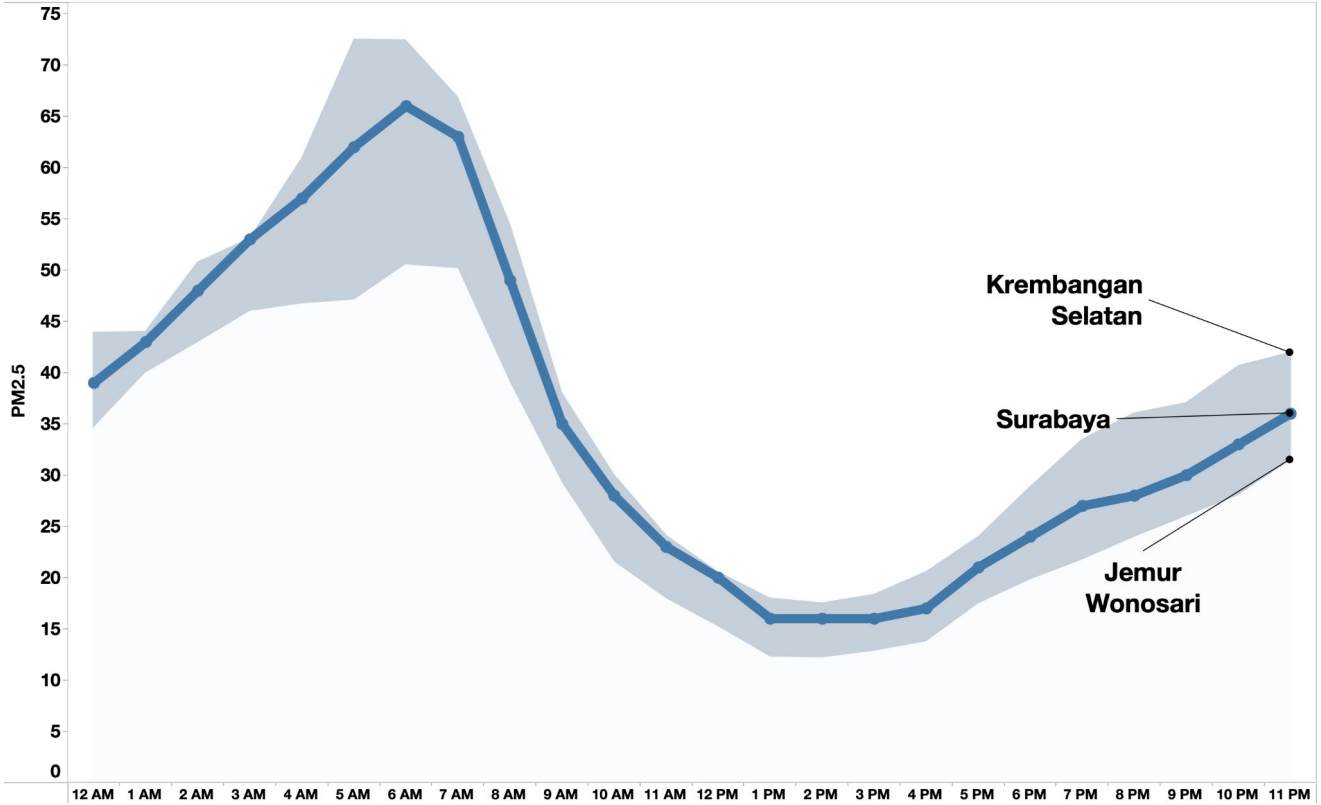



In Yogyakarta, the differences between the best and worst location (Godean & Sorowajan) were not as great as in the Greater Jakarta area.

Data shown is from June 2022.

©2022 Nafas, All rights reserved

# In some regions, the ranges between best and worst locations are not as large

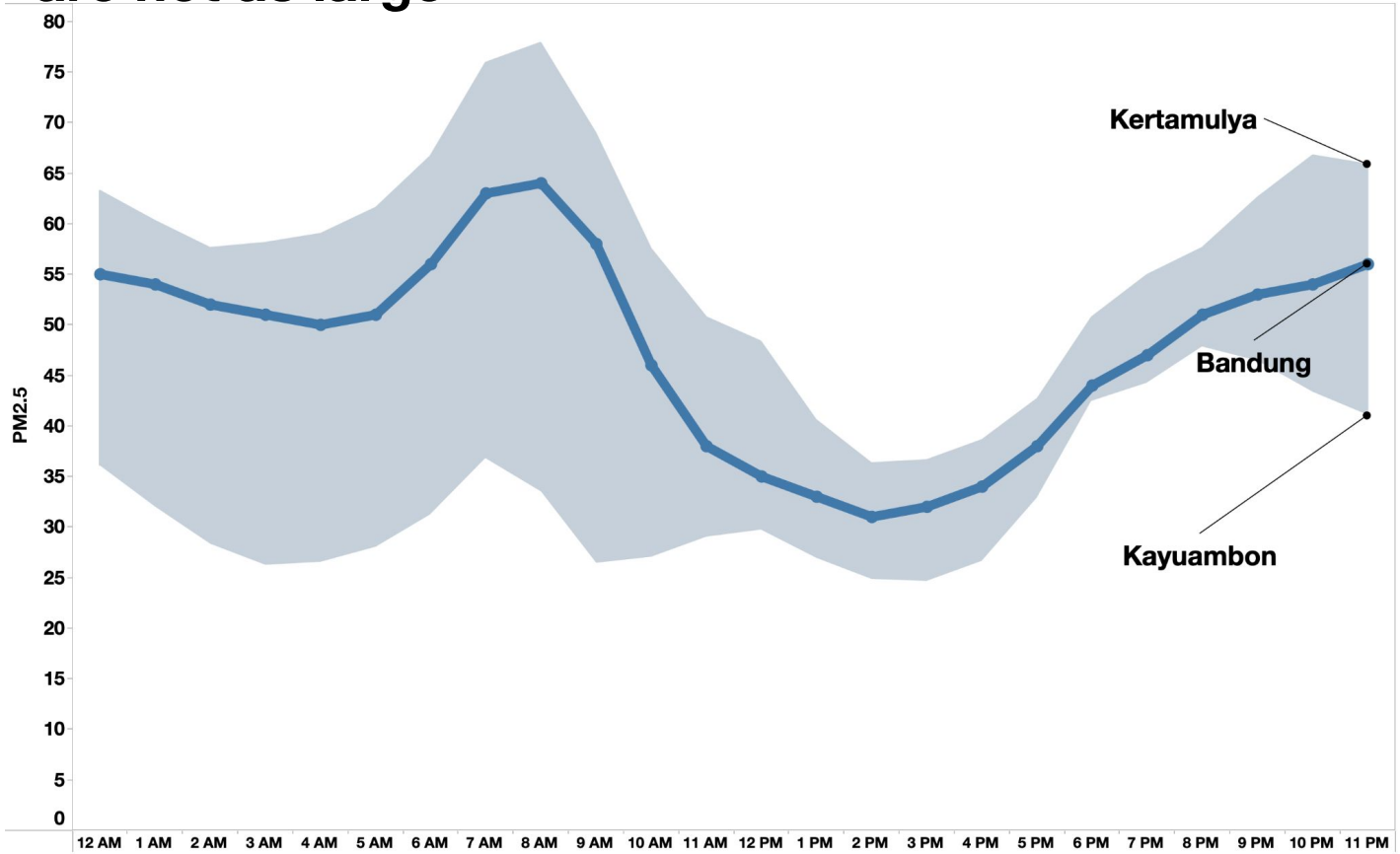



In Yogyakarta, the differences between the best and worst location (Godean & Sorowajan) were not as great as in the Greater Jakarta area.

Data shown is from June 2022.

©2022 Nafas, All rights reserved

# In some regions, the ranges between best and worst locations are not as large




In Bandung, there was a large difference at certain times only - in particular between the hours of 12AM and 9AM, after which the differences became quite small.

Data is from June 2022.

©2022 Nafas, All rights reserved

# 5 Key Myths About Air Pollution in Indonesia

# Data from Nafas in 2021 has shown that

## PM2.5 Pollution is

1. Not reduced by trees/green areas
2. Not reduced when there are less cars, trucks & motorcycles
3. Impacted by seasonality
4. Affected by wind and rain
5. The highest in the morning during exercise hours
6. Not only an outdoor problem, it’s an indoor one too

©2022 Nafas, All rights reserved

# Nafas follows the US Environmental Protection Agency standard for air quality, highlighted in the scale below

It's simple, just remember the colors.

Green is Good
Yellow Sometimes

Orange is not Good
Red is Bad

Purple & Brown is Terrible

| PM2.5 | AQI | Deskripsi |
|---|---|---|
| 0-12.0 | 0-50 | Baik |
| 12.1-35.0 | 51-100 | Moderat |
| 35.1-55.0 | 101-150 | Tidak Sehat Bagi Kelompok Sensitif |
| 55.1-150.0 | 151-200 | Tidak Sehat |
| 150.1-250.0 | 201-300 | Sangat Tidak Sehat |
| >250.0 | 301-500 | Beracun |

©2022 Nafas, All rights reserved

# PM2.5 Is Not Reduced By Trees / Green Areas

# Data from Nafas in 2021 shows that

## PM2.5 Pollution:

1. Is not reduced by trees/green areas
2. Does not decrease when cars, trucks & motorbikes are reduced
3. Is influenced by the season
4. Is affected by wind and rain
5. Highest in the morning during practice hours
6. Is not only outdoor problems, but also indoor problems

©2022 Nafas, All rights reserved

# Nafas follows the US Environmental Protection Agency's air pollution standards, seen on the following scale

It’s simple, just remember the color!

Green= Good
Yellow= Sometimes

Orange = Not Good
Merah = Bad

Ungu & Cokelat = Very Bad

| PM2.5 | AQI | Deskripsi |
|---|---|---|
| 0-12.0 | 0-50 | Baik |
| 12.1-35.0 | 51-100 | Moderat |
| 35.1-55.0 | 101-150 | Tidak Sehat Bagi Kelompok Sensitif |
| 55.1-150.0 | 151-200 | Tidak Sehat |
| 150.1-250.0 | 201-300 | Sangat Tidak Sehat |
| >250.0 | 301-500 | Beracun |

©2022 Nafas, All rights reserved

# PM2.5 Is Not Reduced By Trees/Green Area

# Until now, green areas are still one of the strategies to reduce air pollution

LINGKUNGAN

Pentingnya Menanam Pohon di Lingkungan Sekitar

**Peringati Hari Lingkungan Hidup dengan Gerakan Menanam Pohon**

Peringati Hari Lingkungan Hidup se-Dunia, Semen Padang Tanam Pohon di Area Reklamasi Tambang

Riki Suardi — Jumat, 10 Jun 2022 | 17:46 WIB

**Hijaukan Bumi Dengan Menanam Pohon Di Sekitar Rumah**

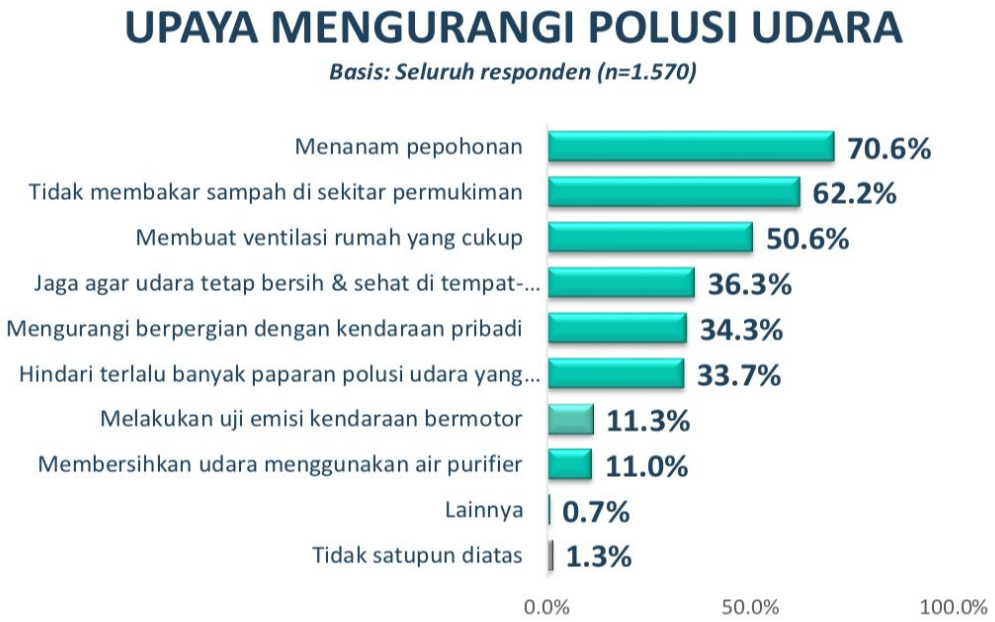
*Source: Travel Kompas, 2022*

*©2022 Nafas, All rights reserved*

# People assume that planting trees is the solution to air pollution

**71%**

of respondents believe that planting trees is a solution to overcome air pollution




©2022 Nafas, All rights reserved

Source: Katadata, KIC Report

# Research by USDA Forest Service proves that trees do not significantly reduce PM2.5 pollution

Environmental Pollution 178 (2013) 395–402

Contents lists available at SciVerse ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol

## Modeled $PM_{2.5}$ removal by trees in ten U.S. cities and associated health effects

David J. Nowak [a,*], Satoshi Hirabayashi [b], Allison Bodine [b], Robert Hoehn [a]

[a] USDA Forest Service, 5 Moon Library, SUNY-ESF, Syracuse, NY 13210, USA
[b] Davey Institute, 5 Moon Library, SUNY-ESF, Syracuse, NY 13210, USA

ARTICLE INFO

*Article history:*
Received 5 November 2012
Received in revised form
23 March 2013
Accepted 25 March 2013

*Keywords:*
Urban forests
Air pollution removal
Particulate matter
Mortality
Human health

ABSTRACT

Urban particulate air pollution is a serious health issue. Trees within cities can remove fine particles from the atmosphere and consequently improve air quality and human health. Tree effects on $PM_{2.5}$ concentrations and human health are modeled for 10 U.S. cities. The total amount of $PM_{2.5}$ removed annually by trees varied from 4.7 tonnes in Syracuse to 64.5 tonnes in Atlanta, with annual values varying from $1.1 million in Syracuse to $60.1 million in New York City. Most of these values were from the effects of reducing human mortality. Mortality reductions were typically around 1 person $yr^{-1}$ per city, but were as high as 7.6 people $yr^{-1}$ in New York City. Average annual percent air quality improvement ranged between 0.05% in San Francisco and 0.24% in Atlanta. Understanding the impact of urban trees on air quality can lead to improved urban forest management strategies to sustain human health in cities.

Published by Elsevier Ltd.

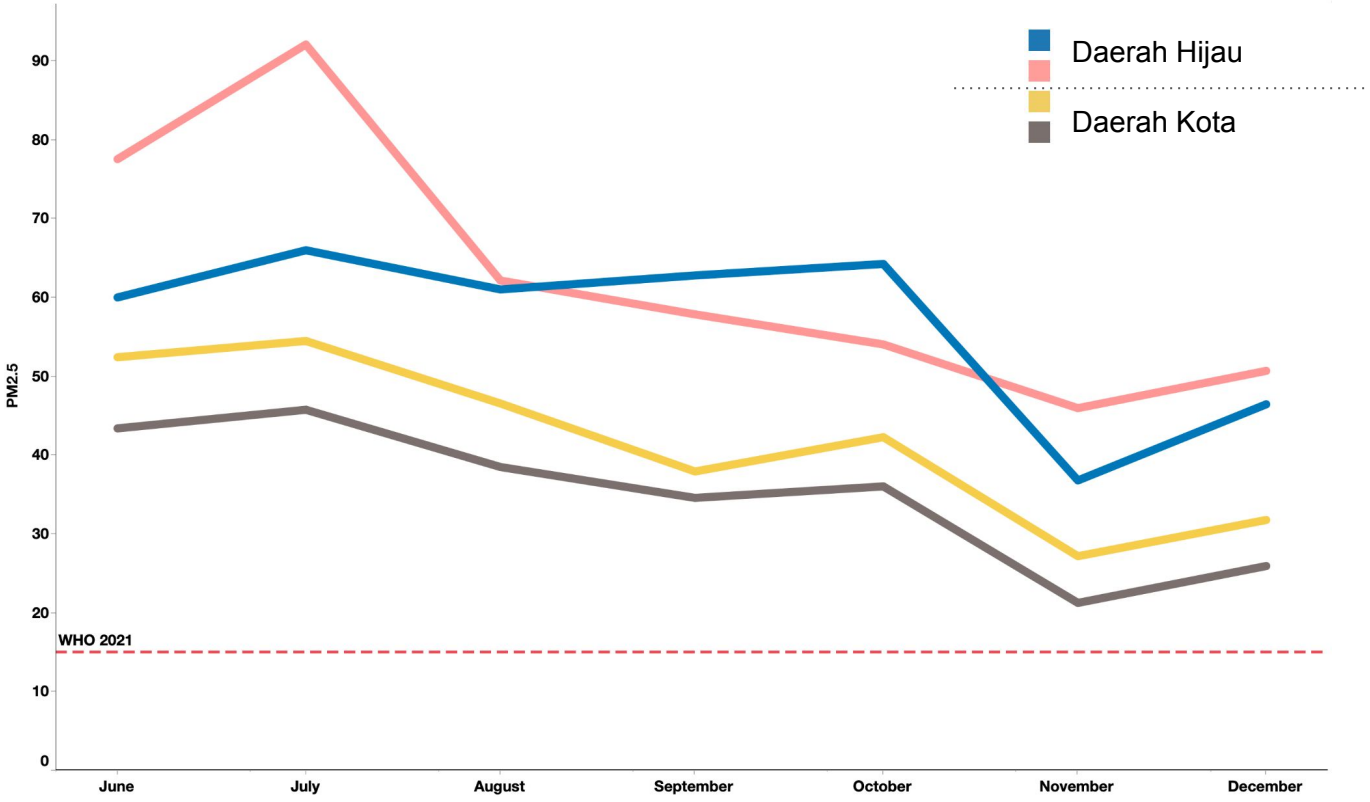
**0.05% - 0.24%**

Average annual air quality improvement caused by vegetation or trees in the center of a city

©2022 Nafas, All rights reserved

*Source: Elsevier, Environmental Pollution 178*

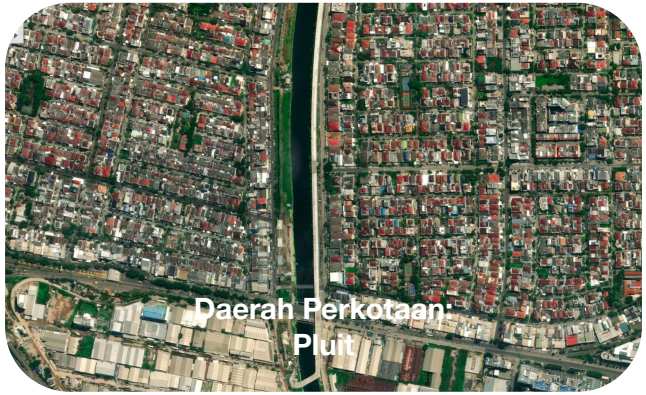
# Areas With Many Trees Don't Always Have Clean Air

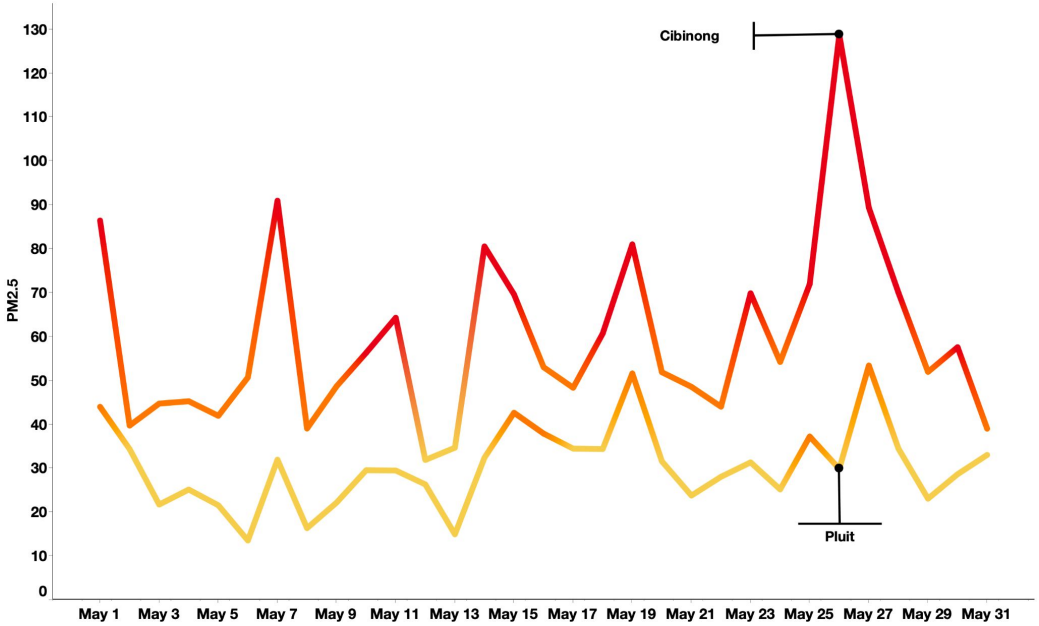



©2022 Nafas, All rights reserved

*Source: nafas, Jun - Dec 2021*

# PM2.5 Pollution in Green Areas Is Not Always Lower Than Cities

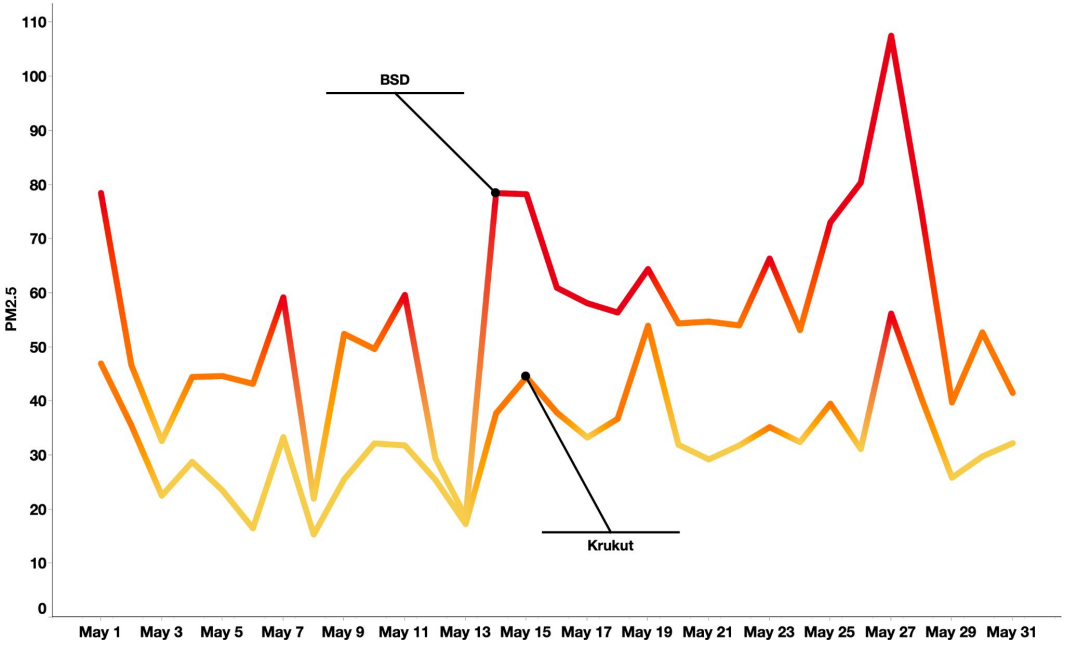



©2022 Nafas, All rights reserved

*Source: nafas, May 2022*

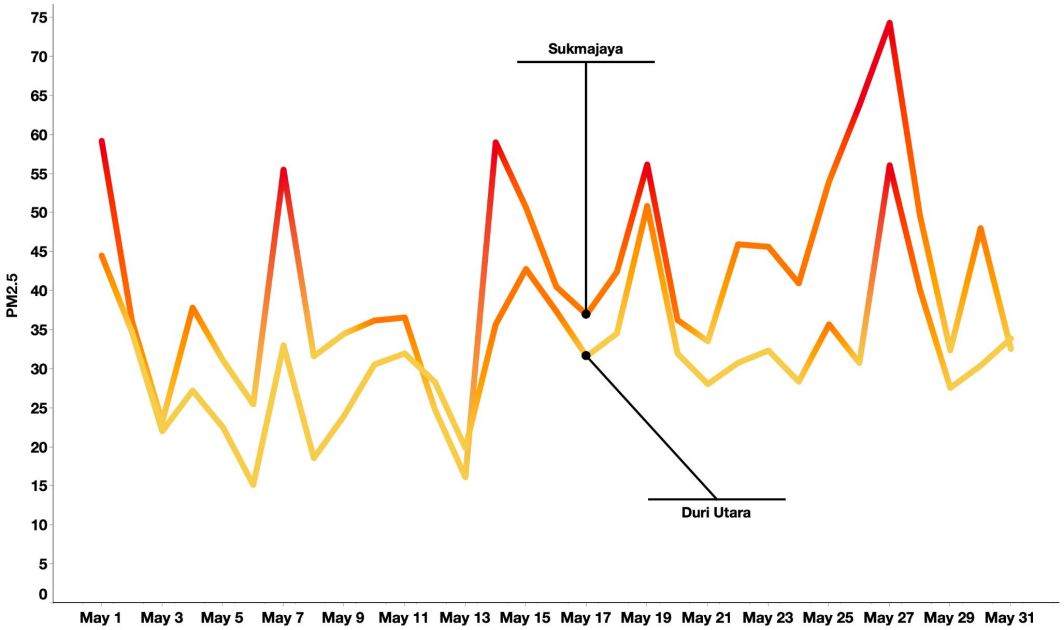
# PM2.5 Pollution in Green Areas Is Not Always Lower Than Cities




©2022 Nafas, All rights reserved

*Source: nafas, May 2022*

# PM2.5 Pollution in Green Areas Is Not Always Lower Than Cities




©2022 Nafas, All rights reserved

*Source: nafas, May 2022*

# Trees Cannot Filter PM2.5

# PM2.5 Pollution Doesn't Drop With the Reduction of Vehicle Mobility

# It is said that vehicles contribute to PM2.5 Pollution by 70%

"Emissions from vehicles contribute 70% to the pollution of Nitrogen Oxide (NOx), Carbon Monoxide (CO), Sulfur Dioxide (SO2) and Particulates (PM) in urban areas."

KLHK, June 2021
Sumber: KLHK

“The transportation sector is the main source of air pollution, especially for pollutants like NOx (72.40%), CO (96.36%), PM10 (57.99%), and PM2.5 (67.03%)”

KLHK, October 2021
Sumber: KLHK

©2022 Nafas, All rights reserved

# With the PPKM *Darurat*, there are almost no vehicles in Jakarta

Sumber: Liputan 6

Sumber: Detik

# In India, “Lockdown” Lowers PM2.5 by - 48%

Hindustan Times

DELHI NEWS

## Delhi’s PM2.5 levels fell 48% during 2020 lockdown, finds study

Among other cities in India, Chennai and Amritsar recorded even higher improvements in air quality -- with 62% and 51% reductions in PM 2.5 concentrations, respectively

# In Several Cities in the World, Lockdown is effective in reducing PM2.5 Pollution

**Delhi, India → -48%**

**Beijing, China → -50%**

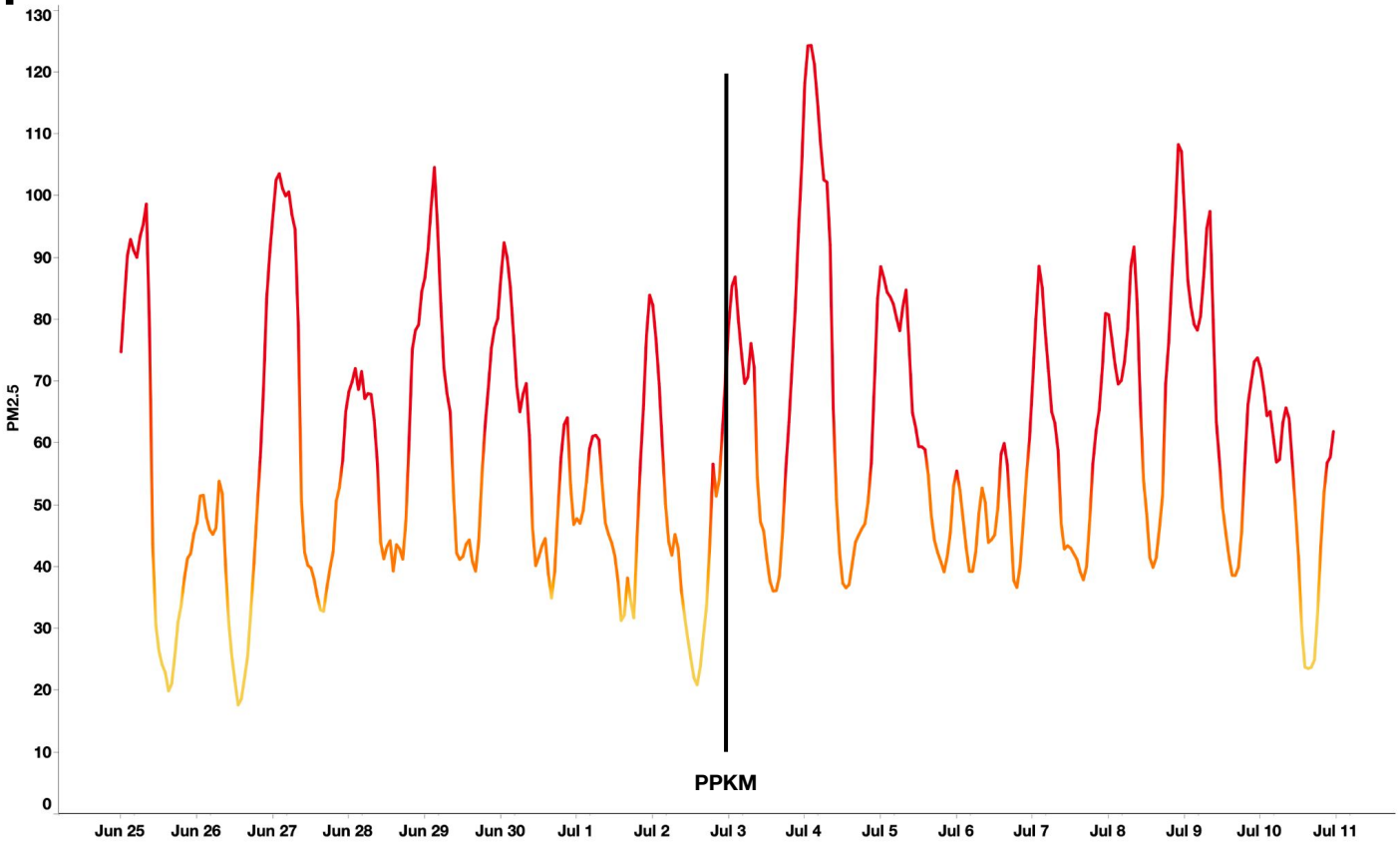
**Shanghai, China → -50%**

**Rome, Italy → -24%**

Sumber: Decline in PM2.5 concentrations over major cities around the world associated with COVID-19, August 2020

# No Cars On The Road, That Means PM2.5 Pollution Should Decrease, Right?

# The decrease in vehicles number does not improve PM2.5 pollution in Jabodetabek



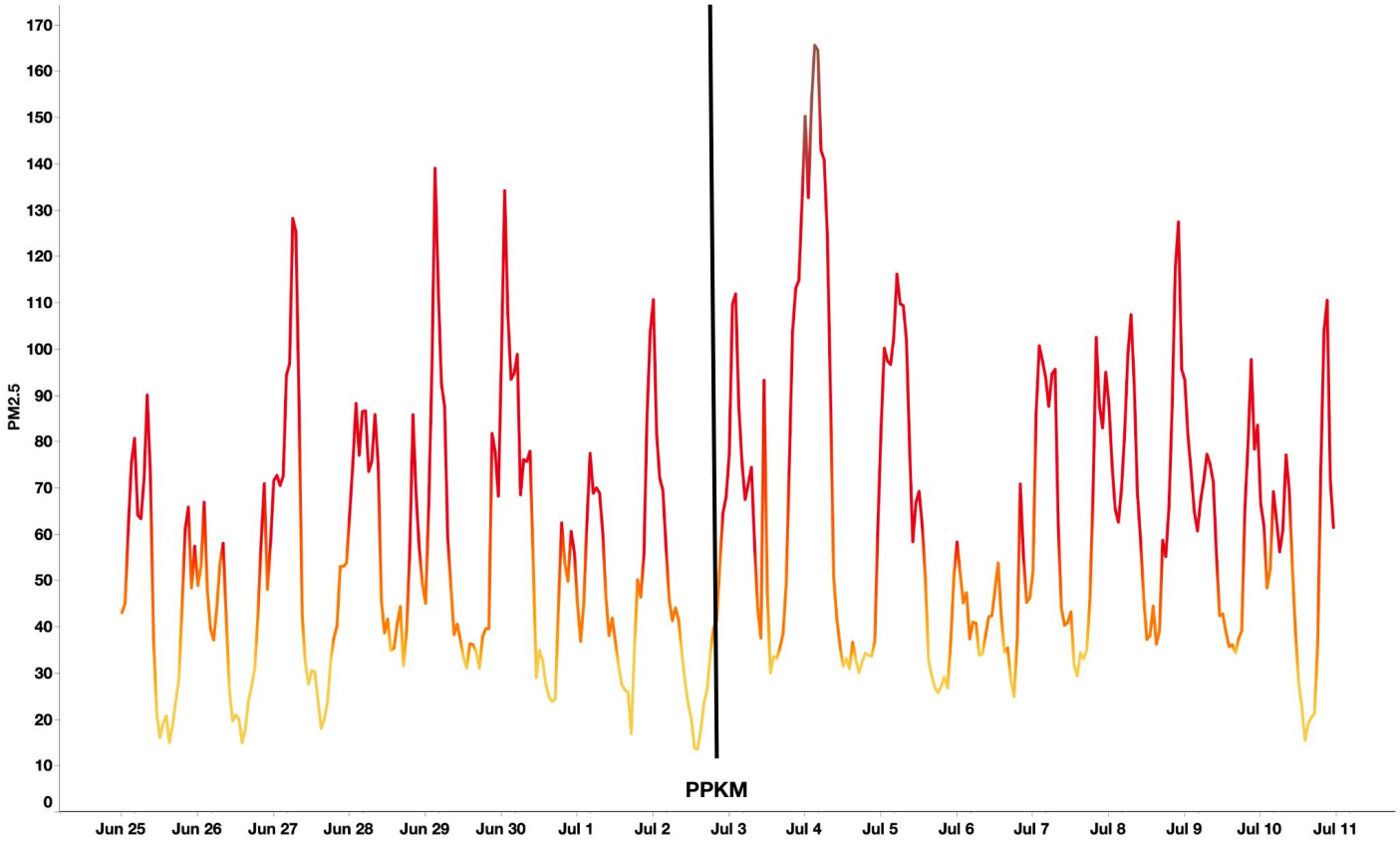

**+12%**

PM2.5 Pollution Increase

*Source: nafas, Jabodetabek Jun - Jul 2021*

*©2022 Nafas, All rights reserved*

# PPKM *Darurat* Period in Kelapa Gading



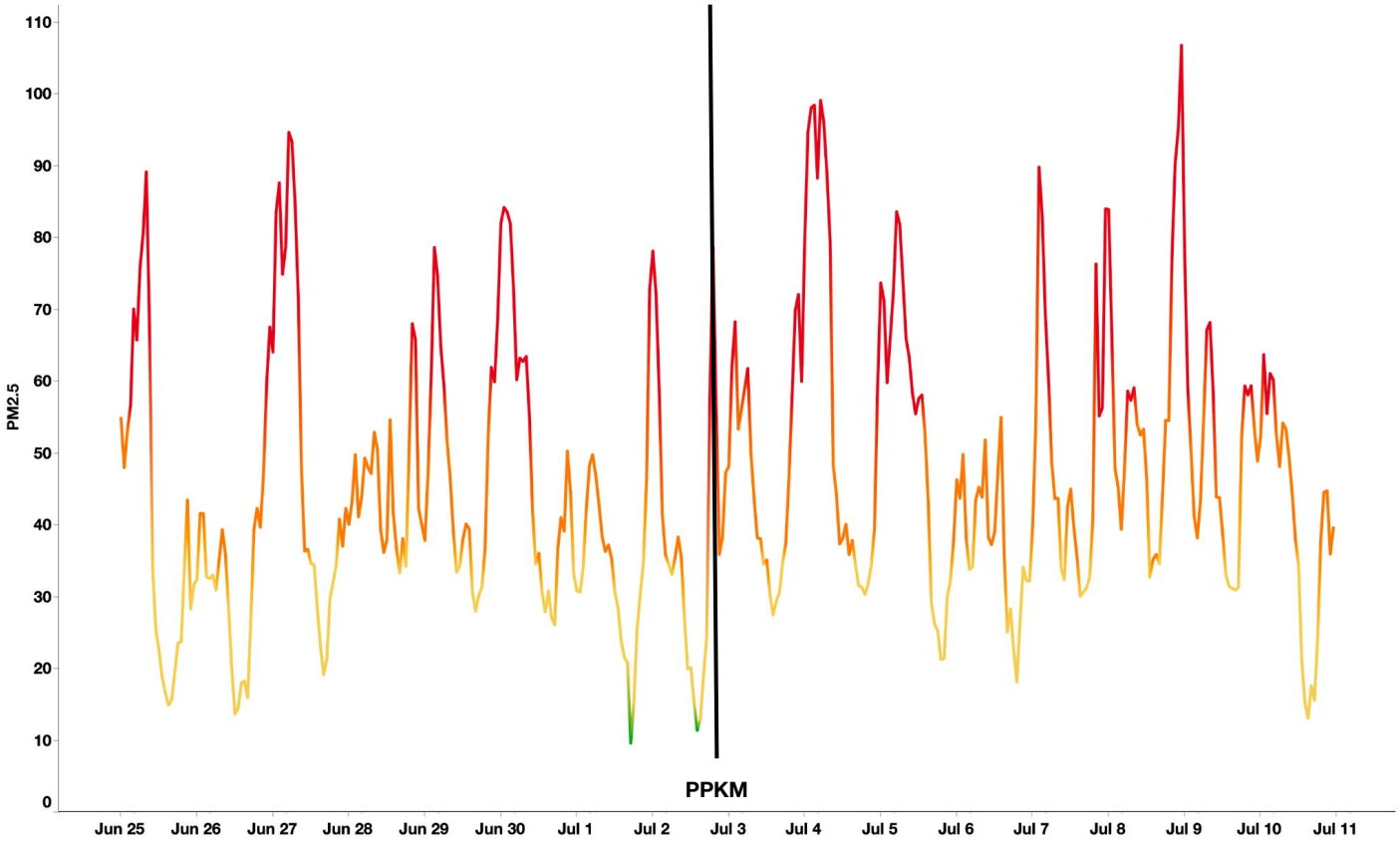

**+21%**

PM2.5 Pollution Increase

*Source: nafas, Kelapa Gading Jun - Jul 2021*

*©2022 Nafas, All rights reserved*

# PPKM *Darurat* Period in Kuningan



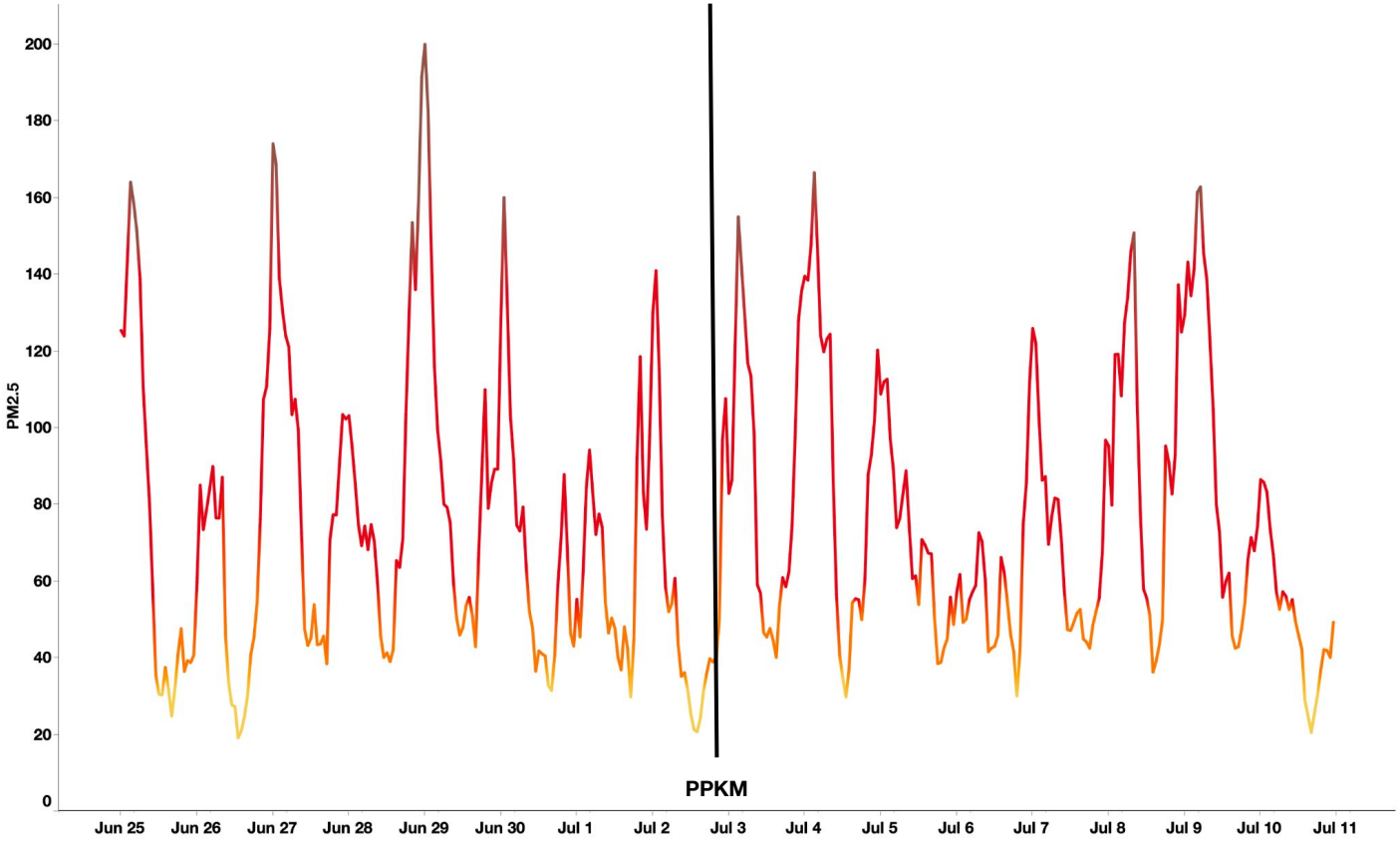

*Source: nafas, Kuningan Jun - Jul 2021*

**+17%**

PM2.5 Pollution Increase

*©2022 Nafas, All rights reserved*

# PPKM *Darurat* Period in Bintaro



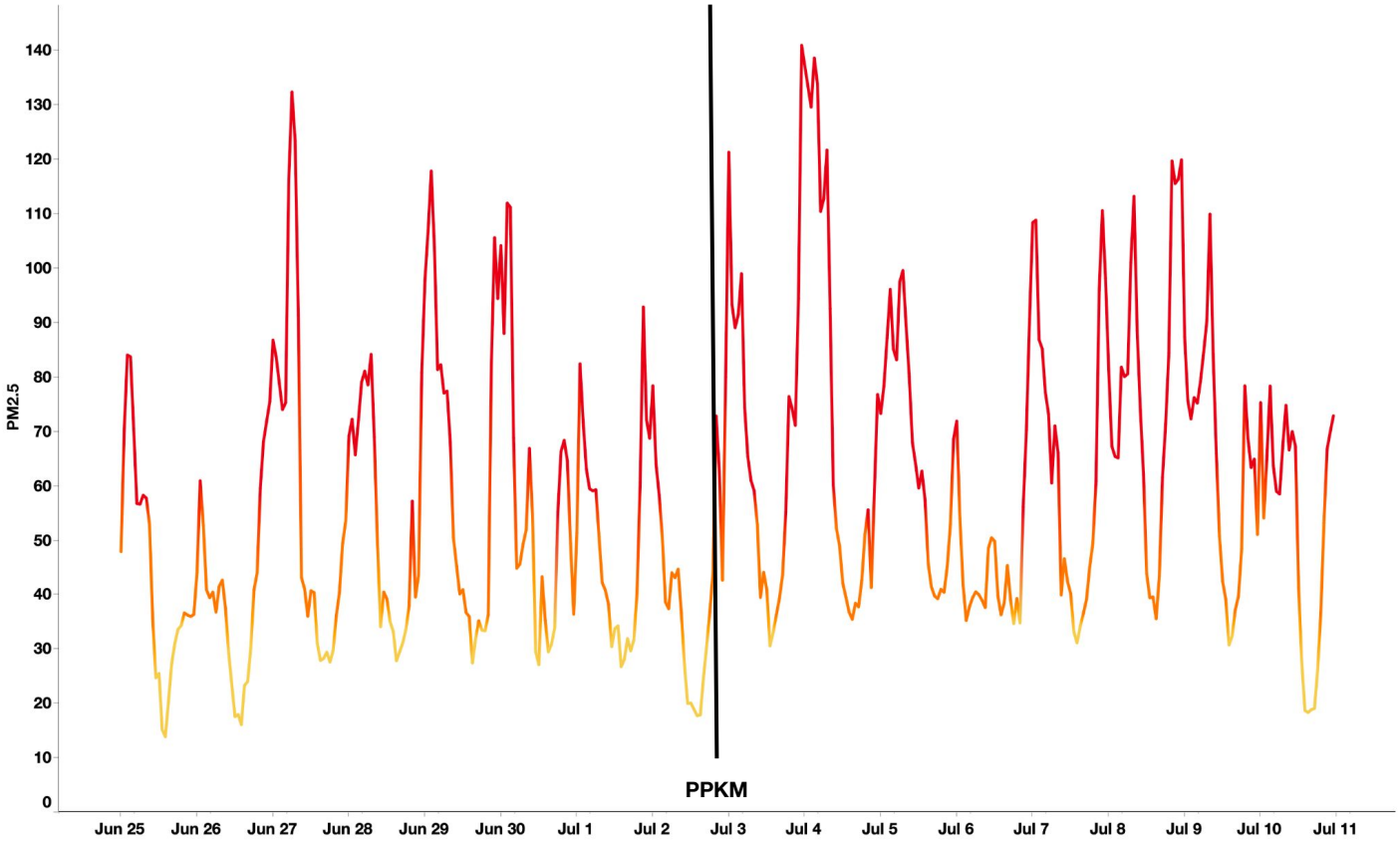

*Source: nafas, Bintaro Jun - Jul 2021*

**+3.4%**

PM2.5 Pollution Increase

*©2022 Nafas, All rights reserved*

# PPKM *Darurat* Period in South Bekasi



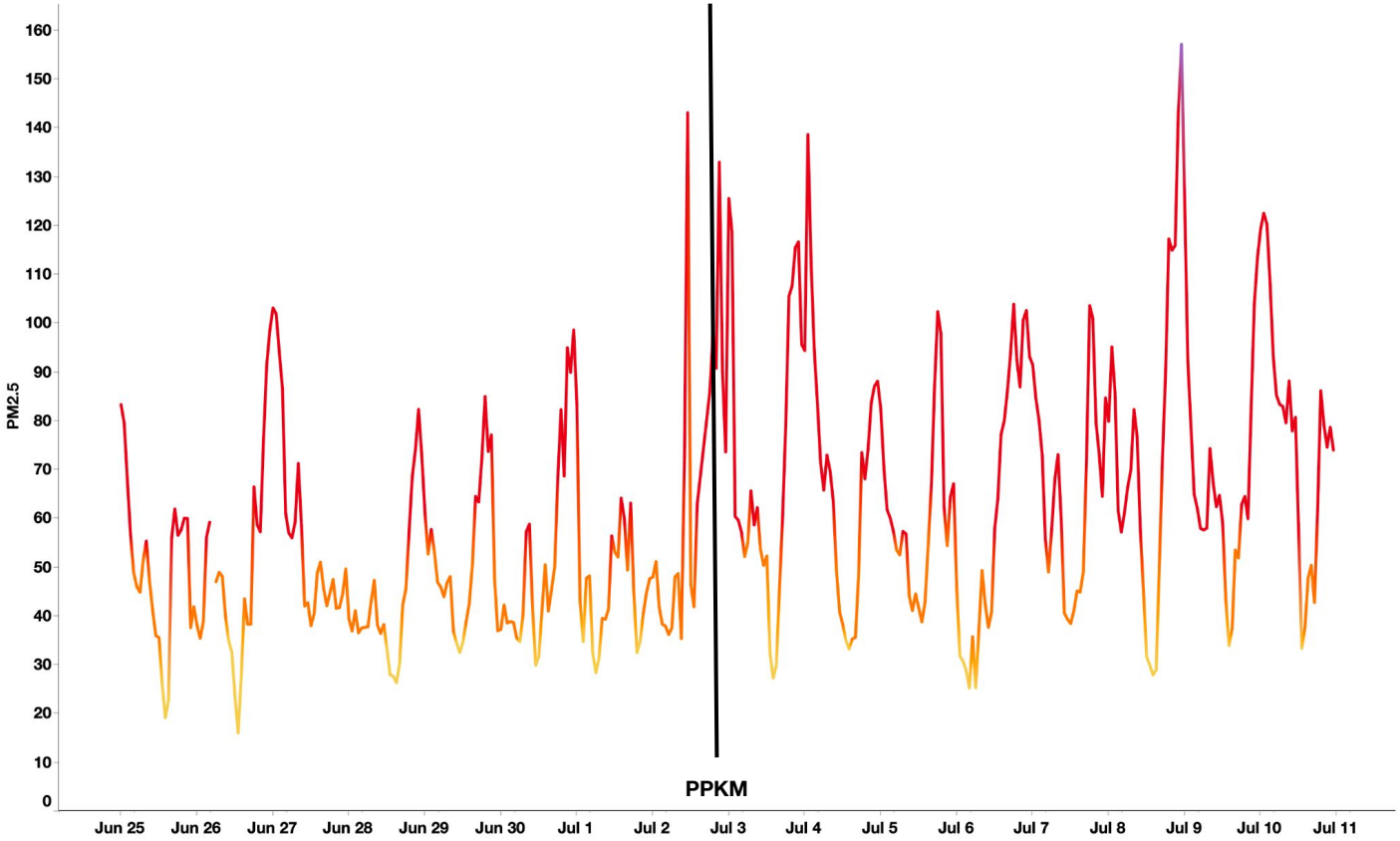

*Source: nafas, Bekasi Selatan Jun - Jul 2021*

**+24%**

PM2.5 Pollution Increase

*©2022 Nafas, All rights reserved*

# PPKM *Darurat* Period in West Bogor



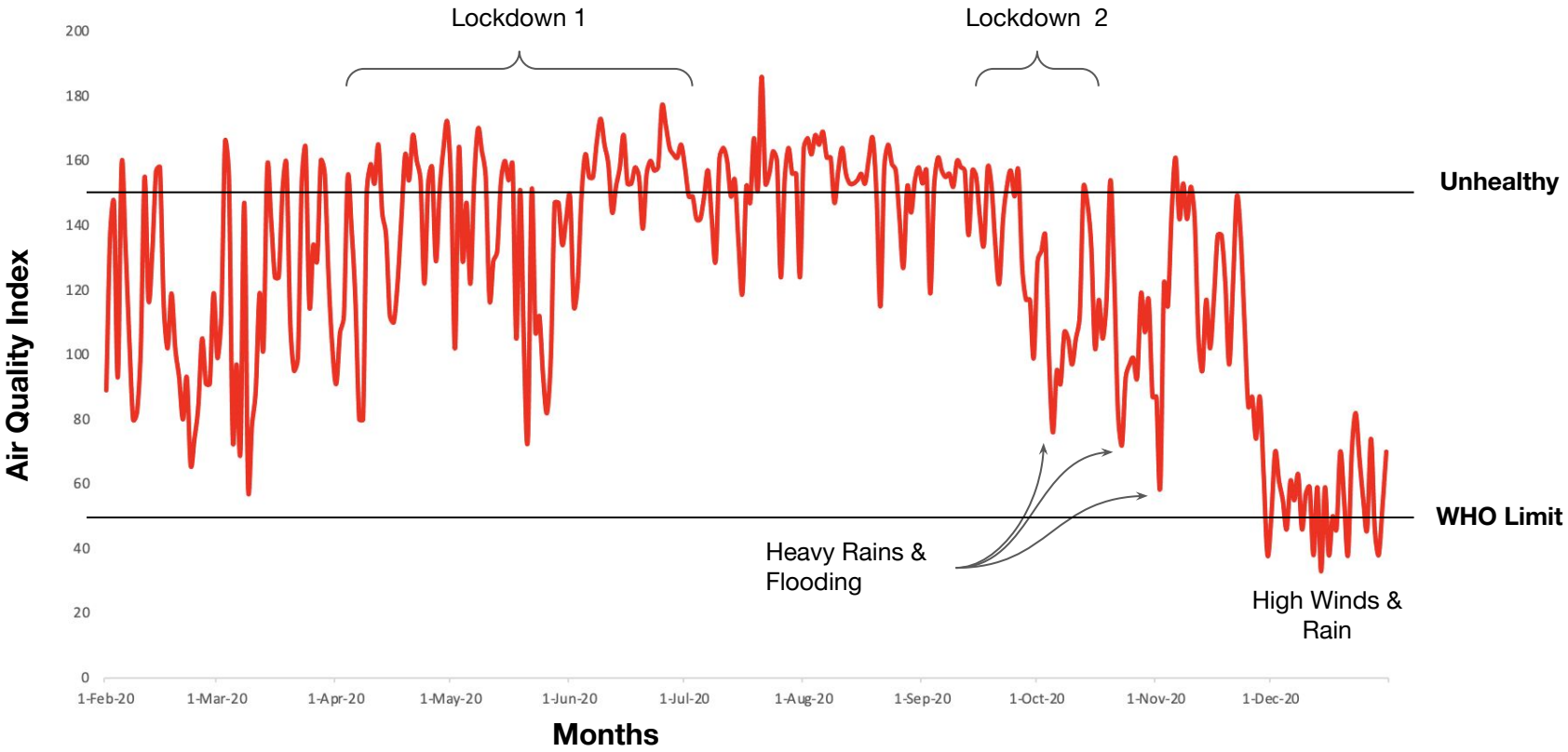

*Source: nafas, Bogor Barat Jun - Jul 2021*

**+33%**

PM2.5 Pollution Increase

*©2022 Nafas, All rights reserved*

# With the PSBB (and WFH) in 2020, there is no significant reduction in PM2.5 either




©2022 Nafas, All rights reserved

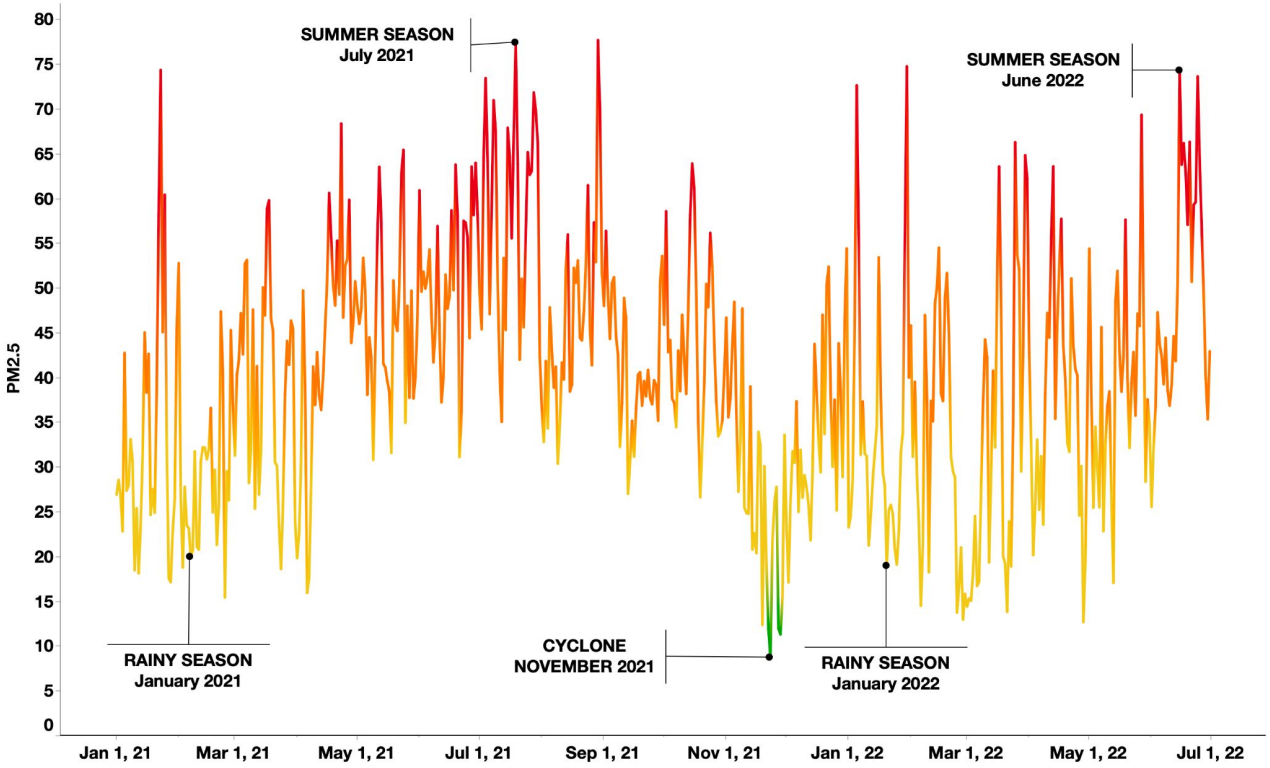
*Source: nafas, South Jakarta Jan - Dec 2020*

# PM2.5 Pollution is Affected By Seasonal Change

Dry season
High PM2.5

Rainy season
Low PM2.5

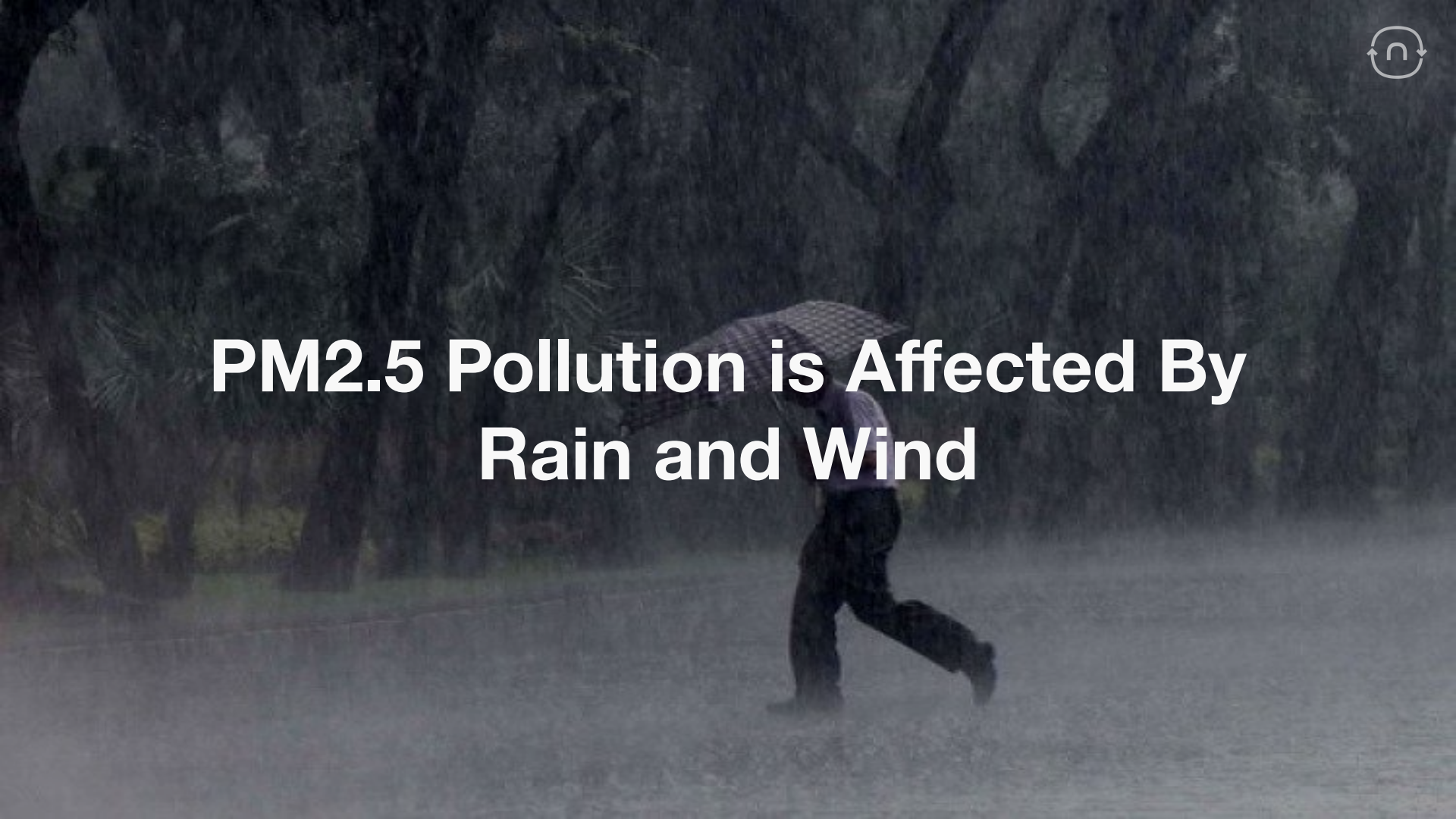
# Entering the Dry Season, PM2.5 Pollution Increases!




*Source: Nafas, Jabodetabek, June 2022*

- As in previous years **dry weather** and **little wind** favor high pollution
- We have just started, the peak will be in **August 2022**
- PM2.5 can be up to **15x** above the WHO standard

©2022 Nafas, All rights reserved



# PM2.5 Pollution is Affected By Rain and Wind

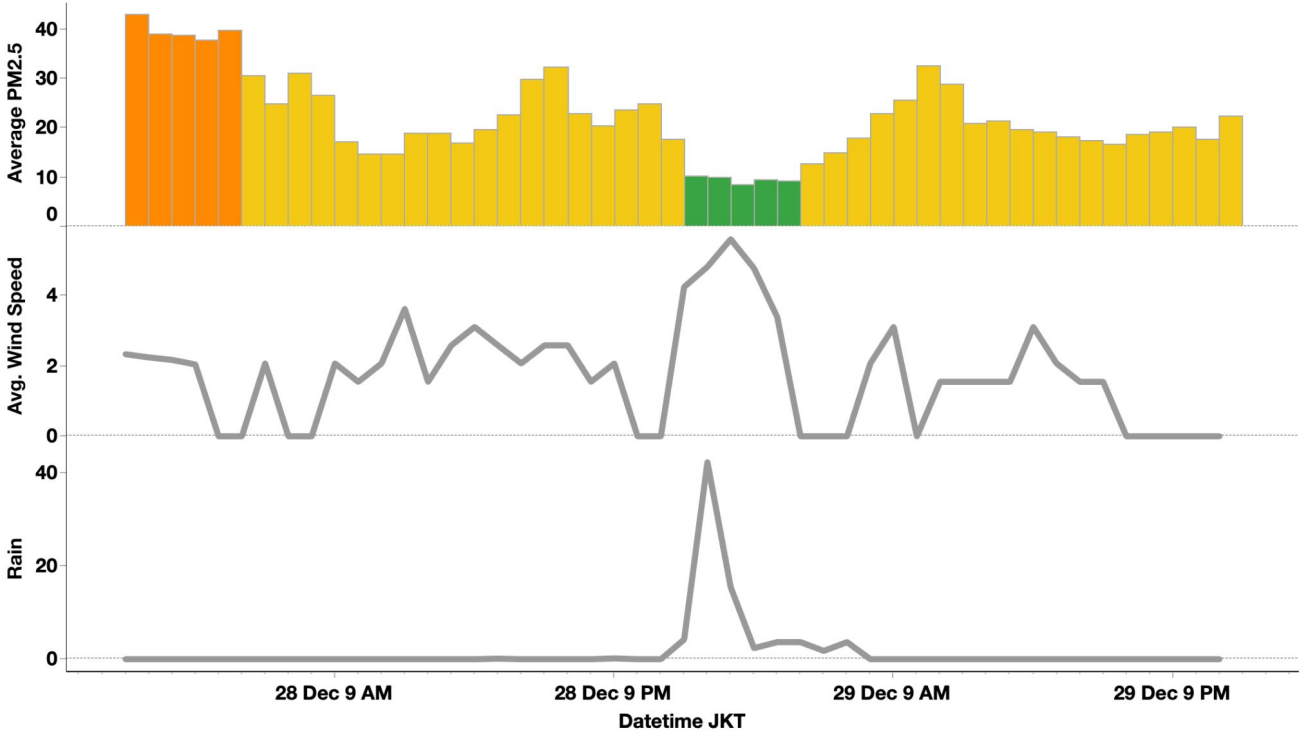
**8.71%**

**Pollution Reduction By Rain**

**66%**

**Pollution Reduction By Wind**

# Fact 1: Rain and Strong Wind = Good Air Quality

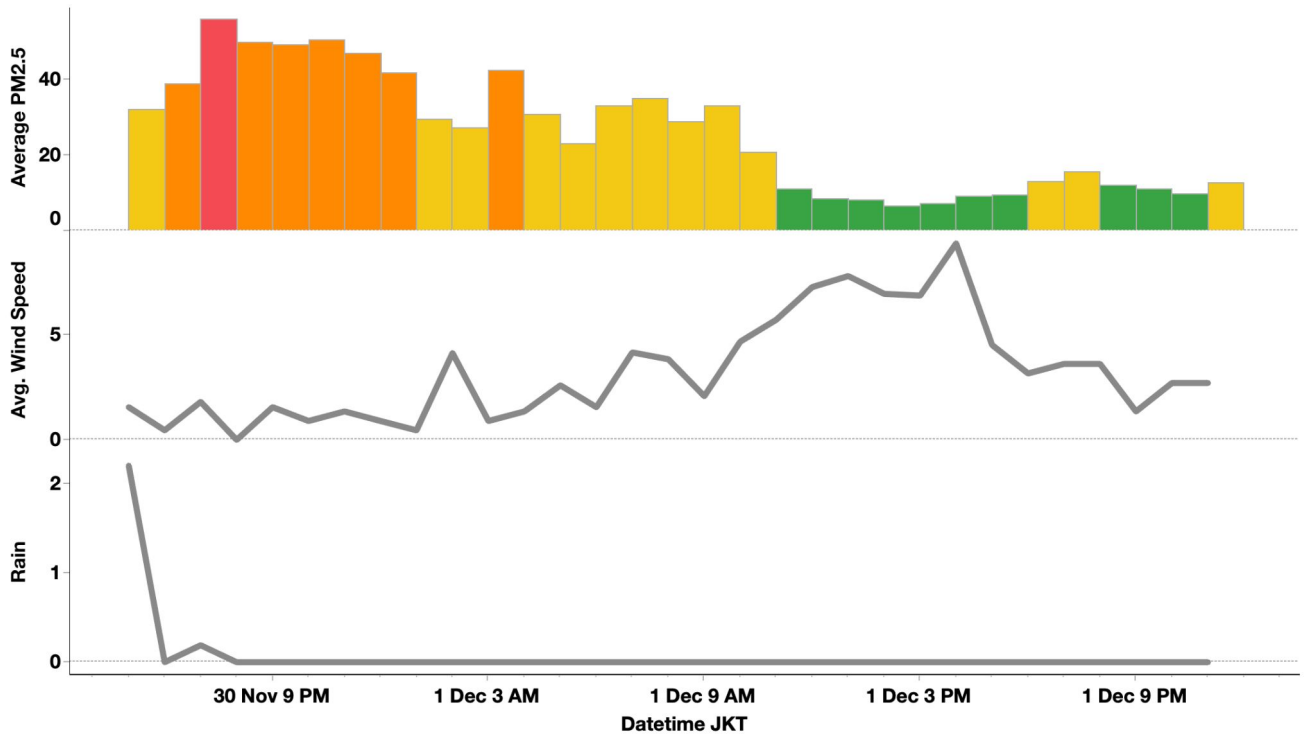



The high intensity of wind and rain causes a significant improvement in air quality.

©2022 Nafas, All rights reserved

*Source: nafas, North Jakarta Dec 2021*

# Fact 2: Strong Wind But No Rain = Good Air Quality

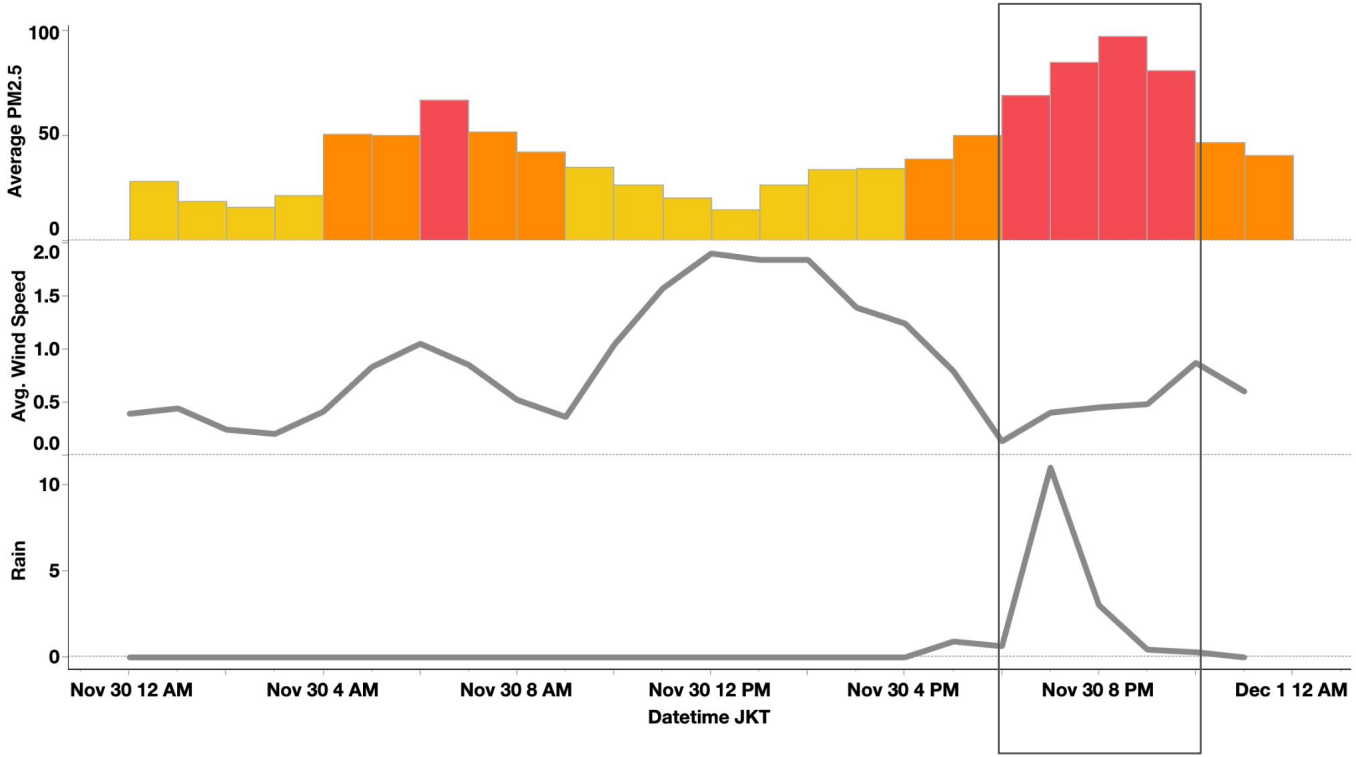



Without rain, wind speed can reduce pollutants significantly

©2022 Nafas, All rights reserved

*Source: nafas, South Jakarta Nov - Dec 2021*

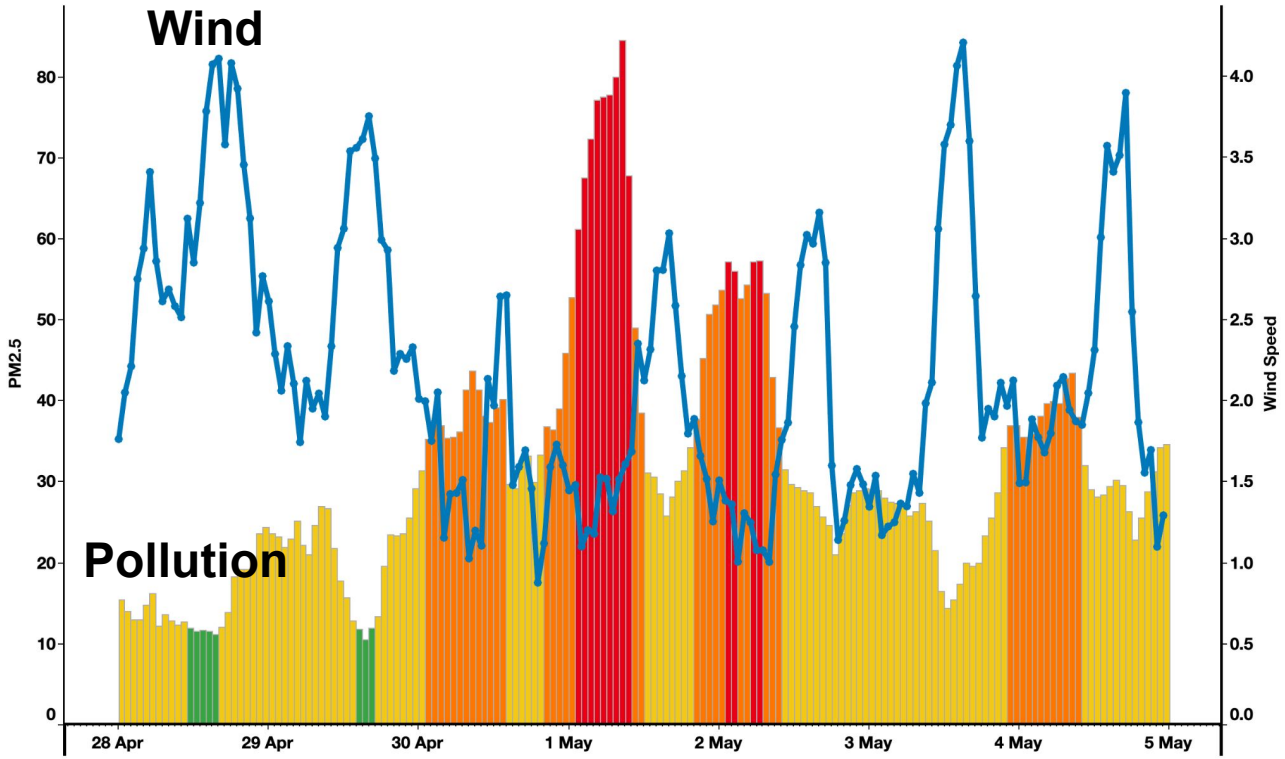
# Fact 3: Rain But No Wind ≠ Good Air Quality




Without wind, rain cannot clean PM 2.5 on its own, efficiently.

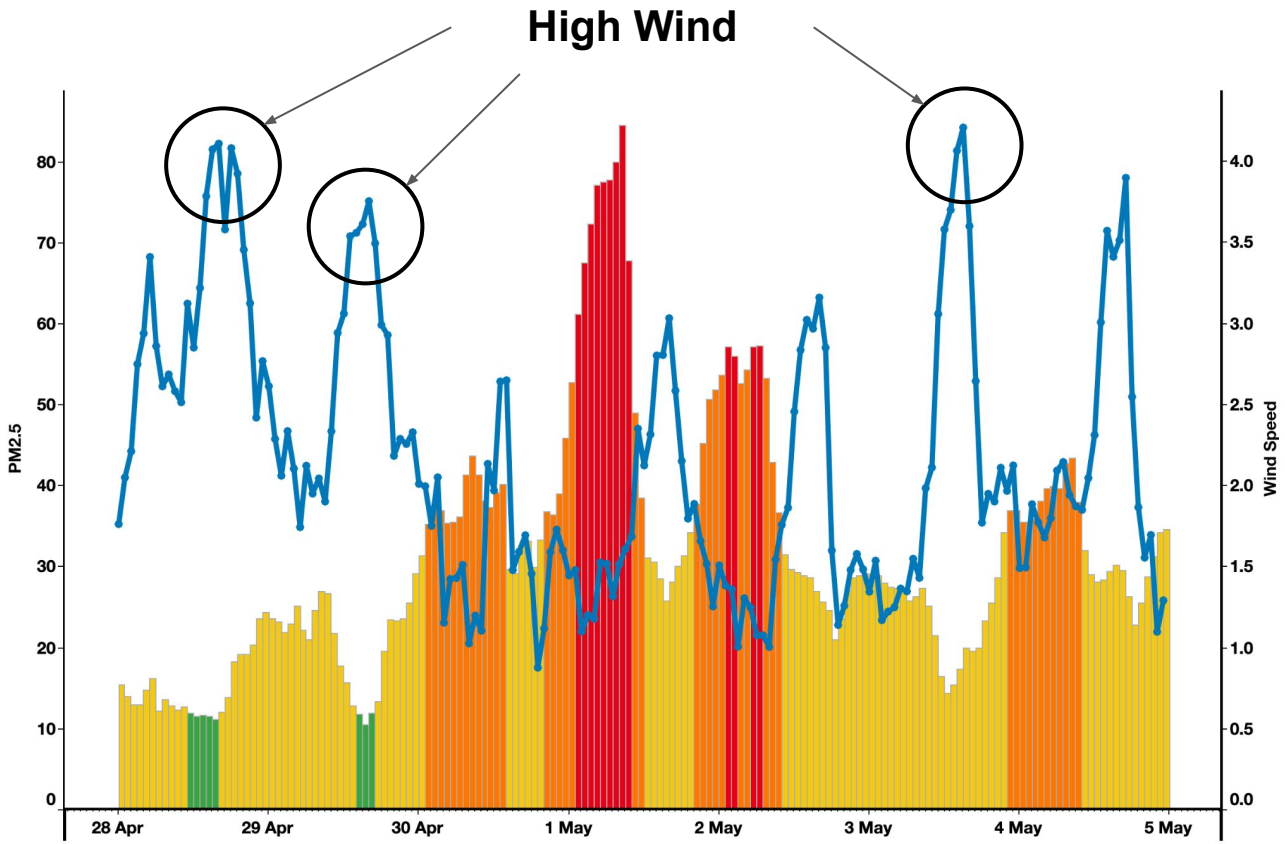
©2022 Nafas, All rights reserved

*Source: nafas, South Tangerang Dec 2021*



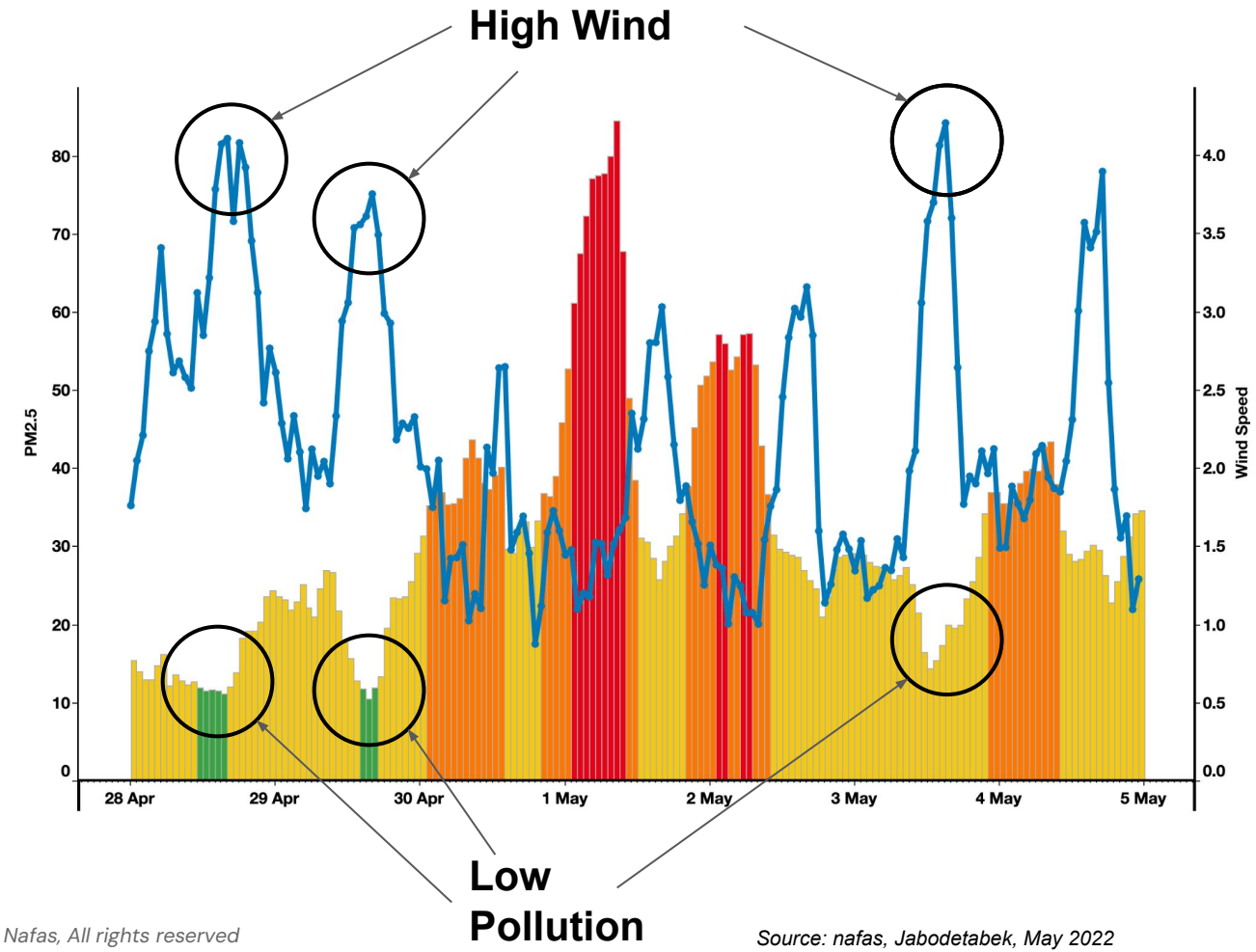

©2022 Nafas, All rights reserved

*Source: nafas, Jabodetabek, May 2022*




©2022 Nafas, All rights reserved

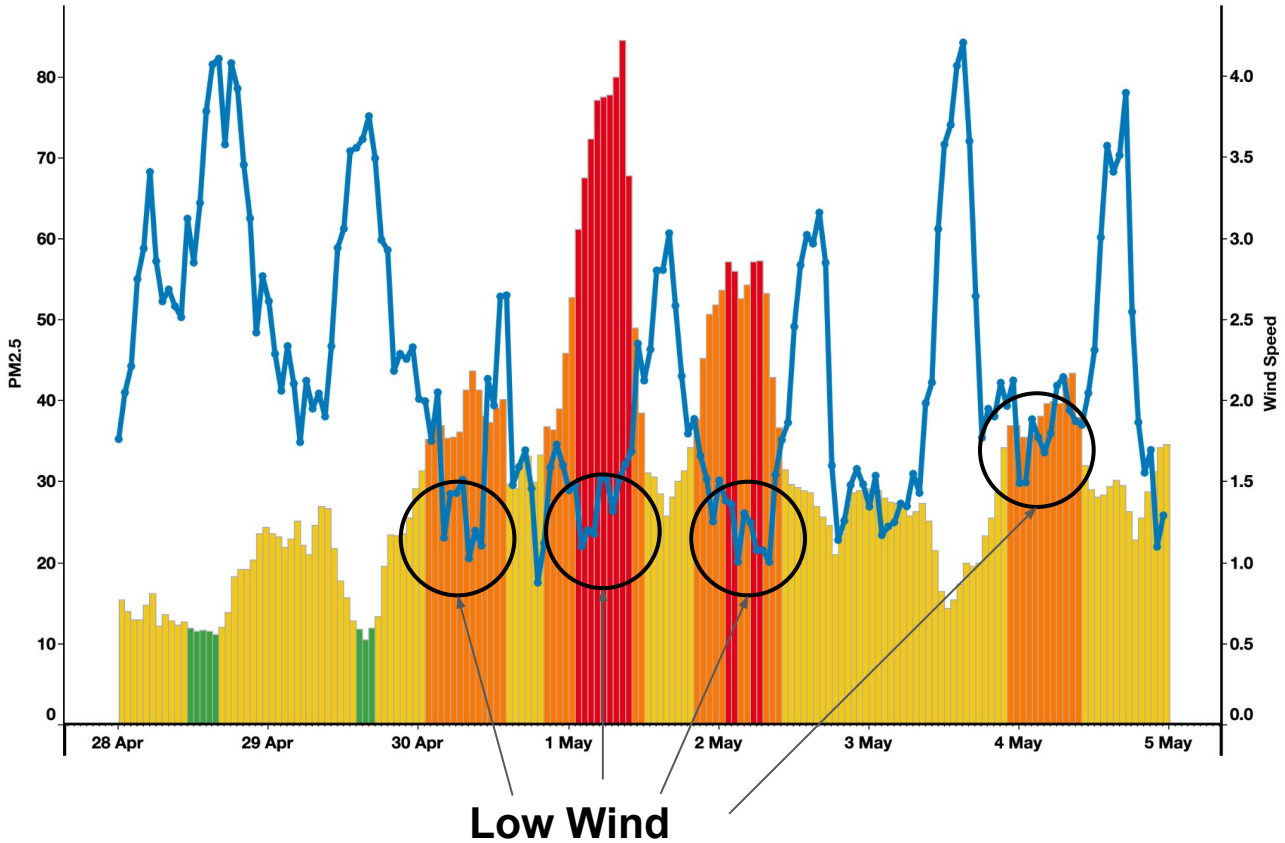
*Source: nafas, Jabodetabek, May 2022*




**High Wind**
**=**
**Low Pollution**

©2022 Nafas, All rights reserved

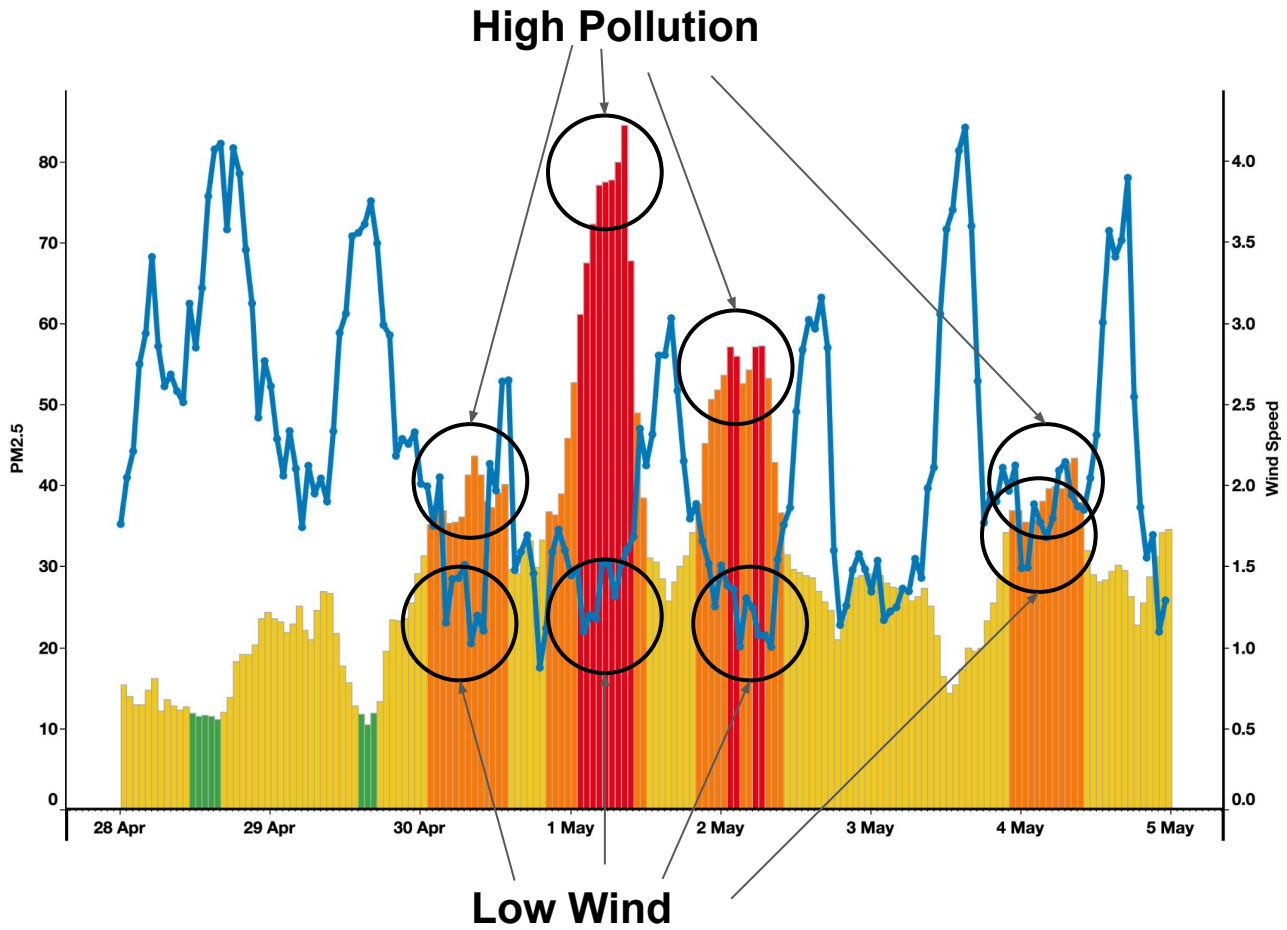
*Source: nafas, Jabodetabek, May 2022*




**High Wind**
**=**
**Low Pollution**

©2022 Nafas, All rights reserved

*Source: nafas, Jabodetabek, May 2022*




**High Wind**
**=**
**Low Pollution**

**Low Wind**
**=**
**High Pollution**

©2022 Nafas, All rights reserved

*Source: nafas, Jabodetabek, May 2022*

# PM 2.5 Pollution is highest in the Morning. How come?

(Be careful for those who exercise outdoors)

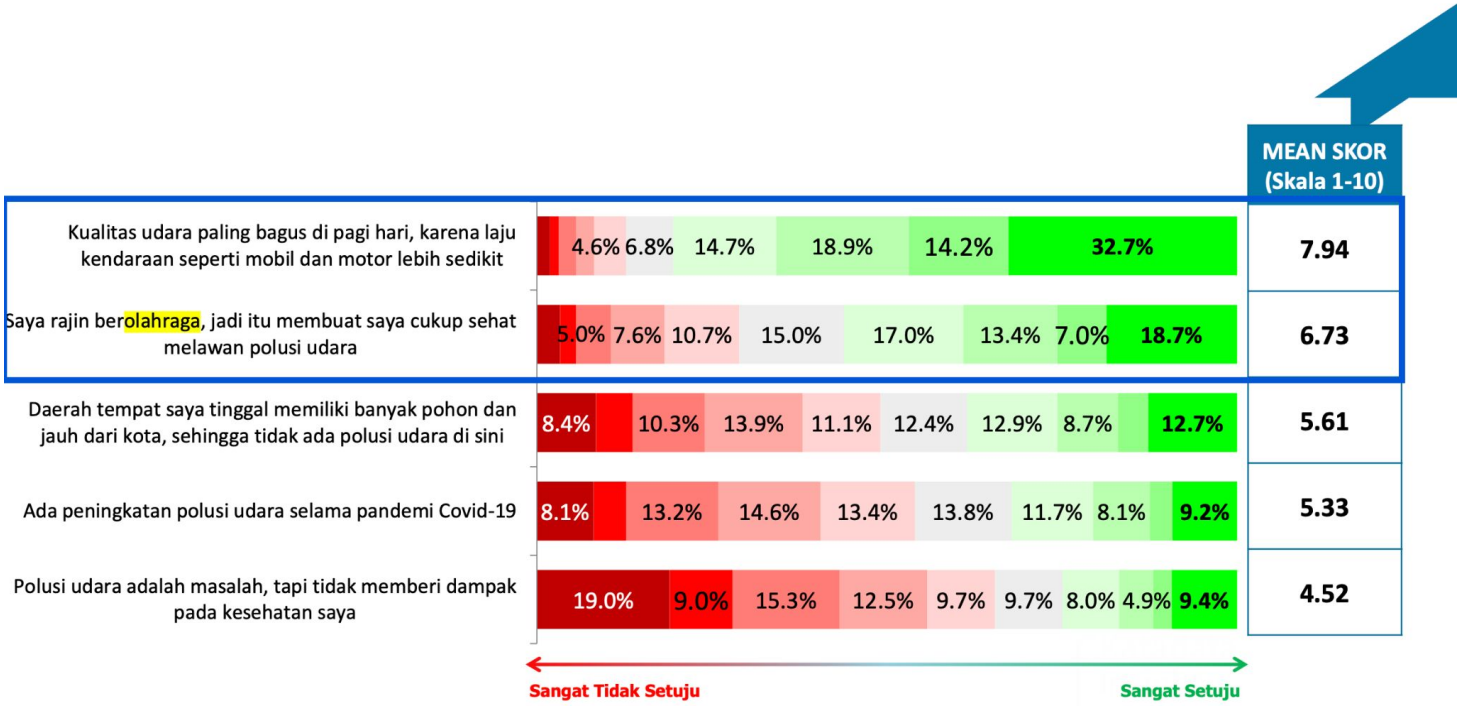
Source: Now Jakarta

# The atmosphere of people exercising during Car Free Day

# The atmosphere of people exercising on Sudirman Street

Source: Detik

# People assume that air quality is best in the morning



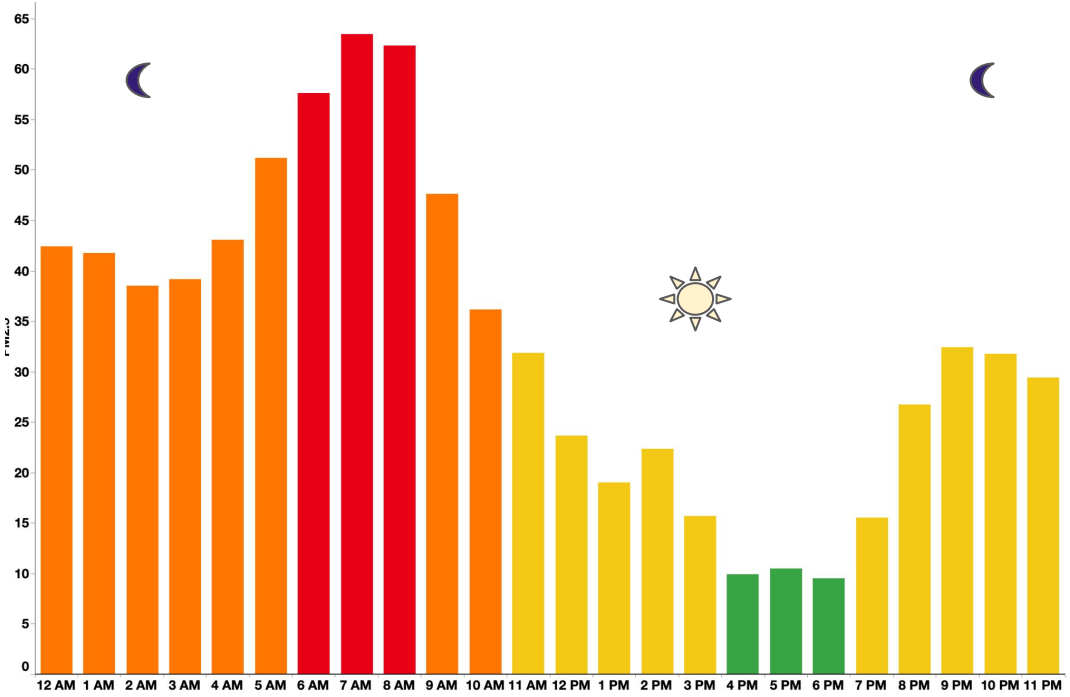

**75%**

of respondents believe the morning has the best air

©2022 Nafas, All rights reserved

*Source: Katadata, KIC Report*

# DKI Jakarta: Gelora




## In May 2022, PM2.5 Pollution is Highest in the Morning!

**The graph shows the movement of pollutants in 24 hours:**

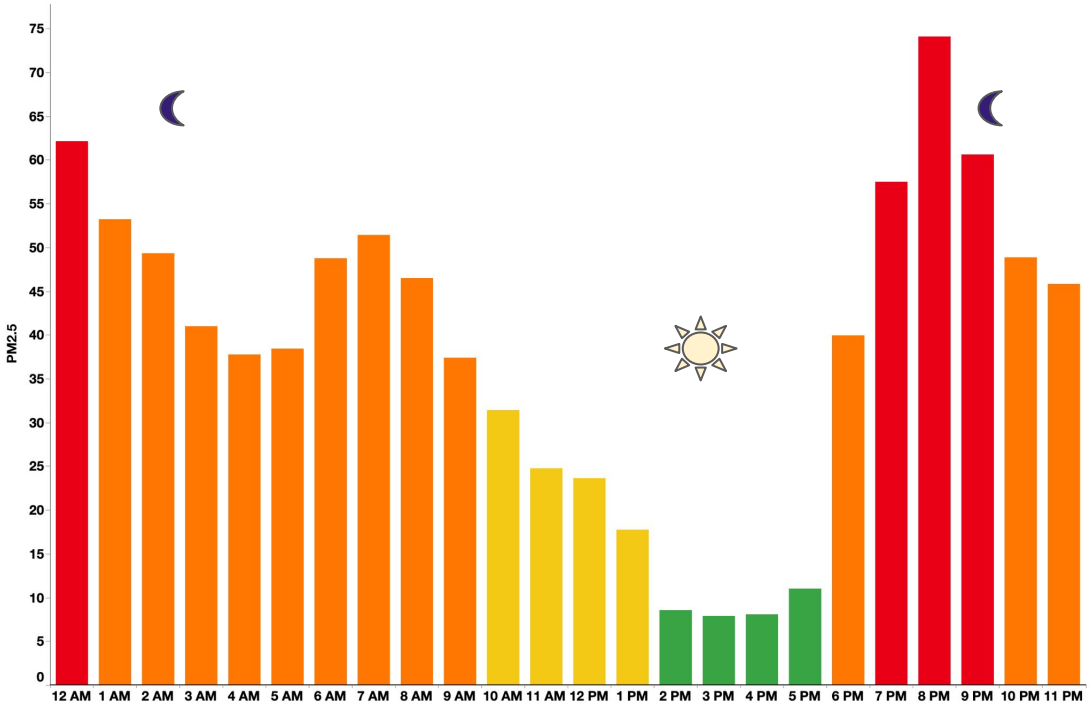
It can be seen that the air quality starts from **unhealthy levels for sensitive groups**

**The improvement** of the air only occurs from 9 am and **peaking at 4 pm**

©2022 Nafas, All rights reserved

*Source: Nafas, Gelora, May 2022*

# DKI Jakarta: Menteng




## In May 2022, PM2.5 Pollution is Highest in the Morning!

**The graph shows the movement of pollutants in 24 hours:**

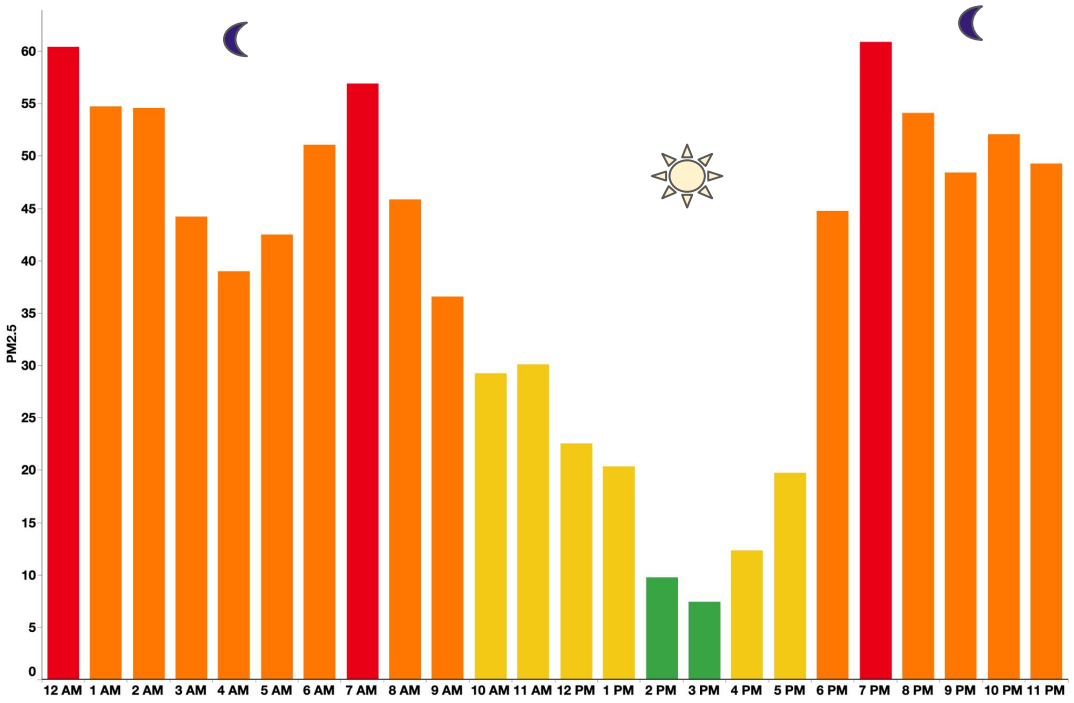
It can be seen that the air quality starts from **unhealthy levels**

**The improvement** of the air only occurs from 9 am to **and peaking at 3 pm**

©2022 Nafas, All rights reserved

*Source: Nafas, Menteng, May 2022*

# DKI Jakarta: Tebet




## In May 2022, PM2.5 Pollution is Highest in the Morning!

**The graph shows the movement of pollutants in 24 hours:**

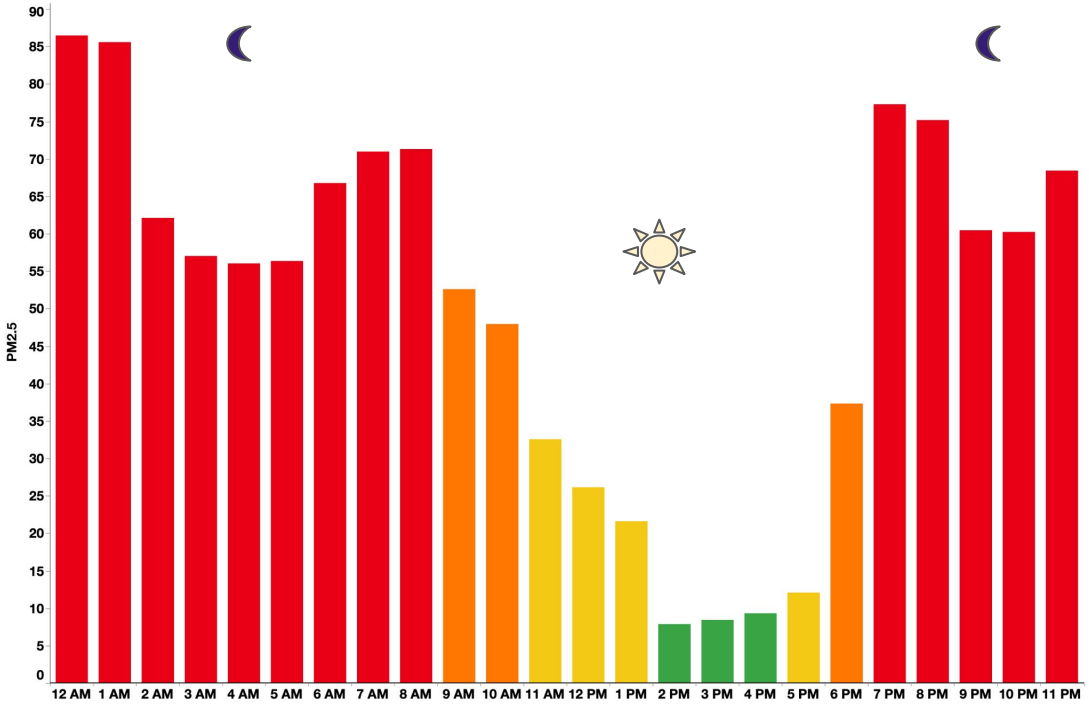
It can be seen that the air quality starts from **unhealthy levels**

**The improvement** of the air only occurs from 9 am and **peaking at 3 pm**

©2022 Nafas, All rights reserved

*Source: Nafas, Tebet, May 2022*

# DKI Jakarta: Kemayoran




## In May 2022, PM2.5 Pollution is Highest in the Morning!

**The graph shows the movement of pollutants in 24 hours:**

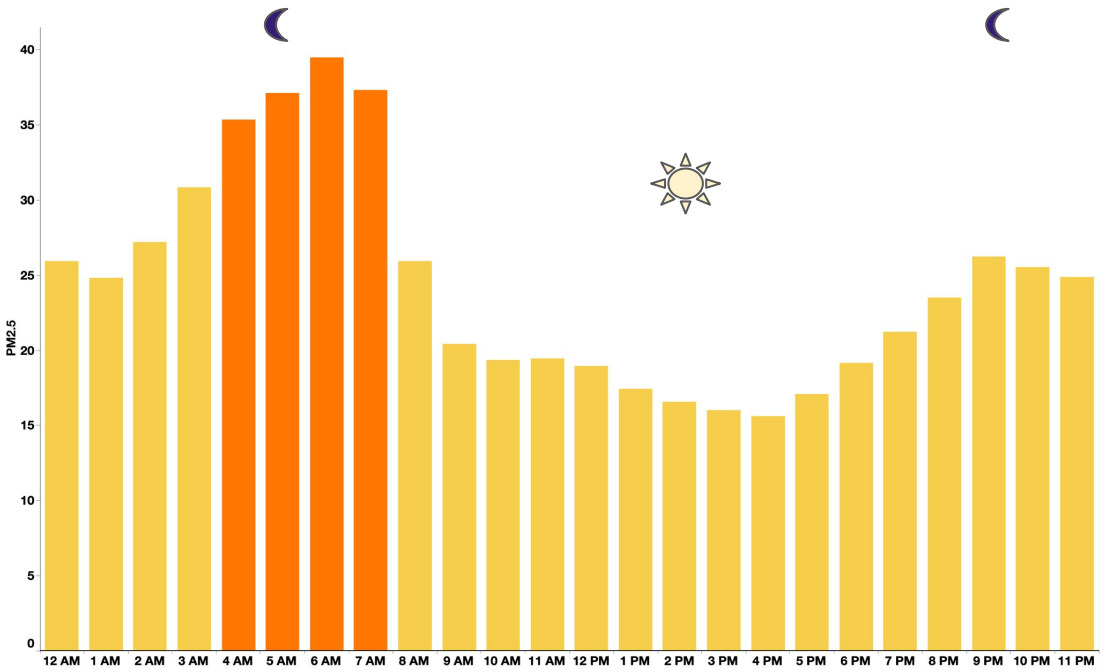
It can be seen that the air quality starts from **unhealthy levels**

**The improvement** of the air only occurs from 9 am and **peaking at 3 pm**

©2022 Nafas, All rights reserved

*Source: Nafas, Kemayoran, May 2022*

# Surabaya: Kertajaya




## In May 2022, PM2.5 Pollution is Highest in the Morning!

**The graph shows the movement of pollutants in 24 hours:**

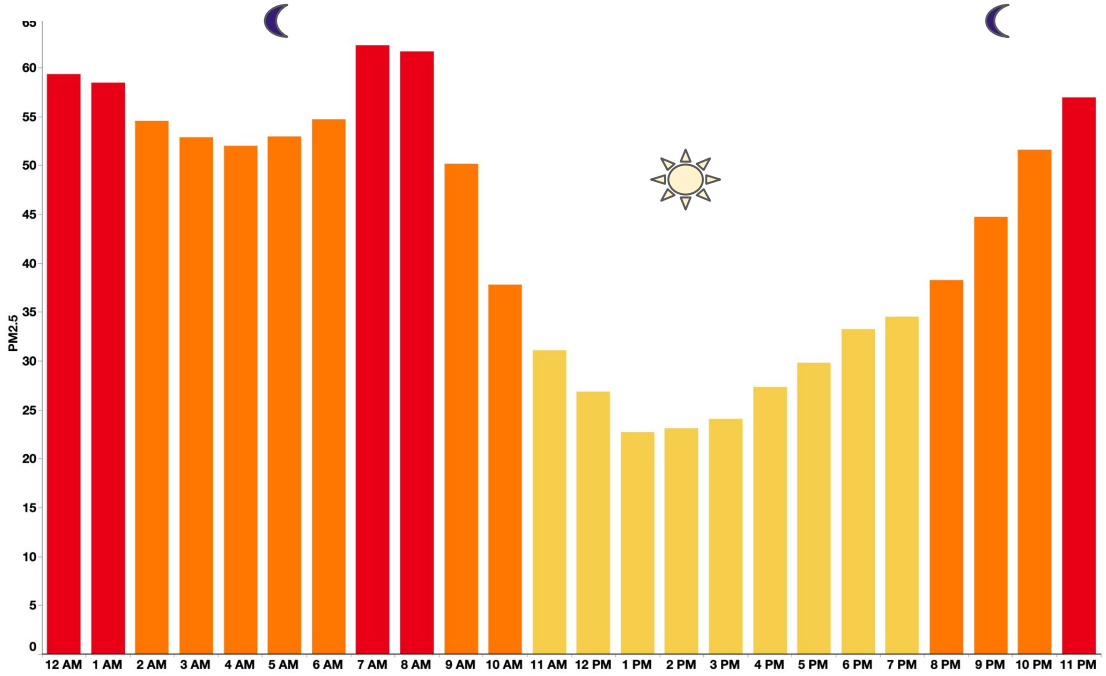
It can be seen that the air quality starts from **unhealthy levels for sensitive groups**

**The improvement** of the air only occurs from 9 am and **peaking at 4 pm**

©2022 Nafas, All rights reserved

*Source: Nafas, Kertajaya,Surabaya, May 2022*

# Bandung: Manjahlega




## In May 2022, PM2.5 Pollution is Highest in the Morning!

**The graph shows the movement of pollutants in 24 hours:**

It can be seen that the air quality starts from **unhealthy levels**

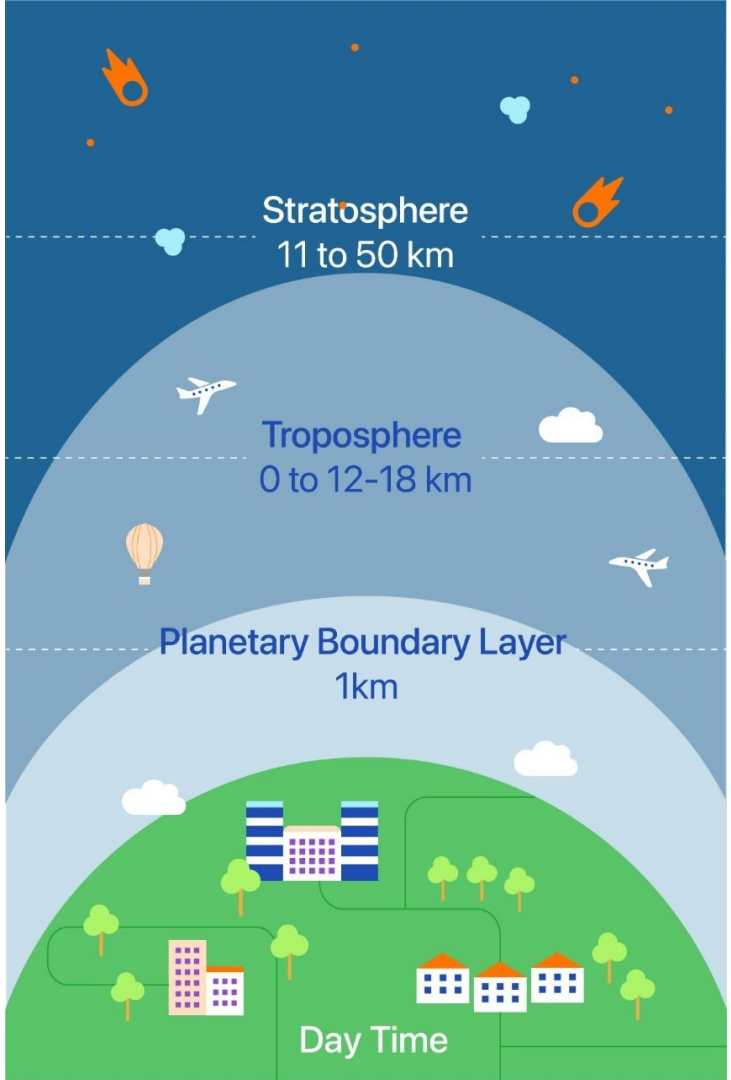
**The improvement** of the air occurs at 9 am and **peaking at 1 pm**

©2022 Nafas, All rights reserved

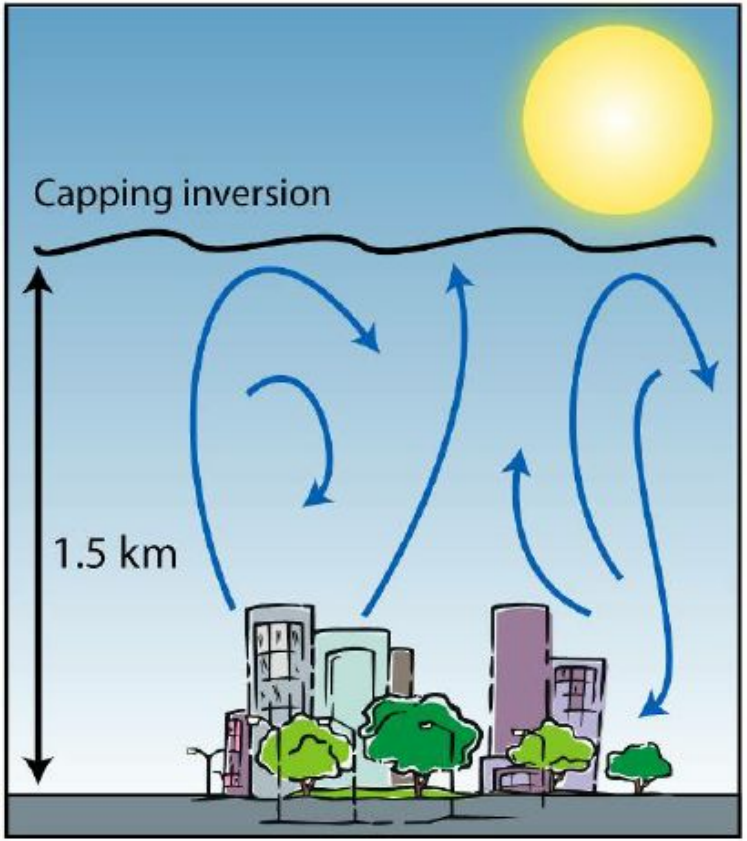
*Source: Nafas, Bandung,Manjahlega, May 2022*

But the streets are nearly empty,
there aren't many cars. How come?

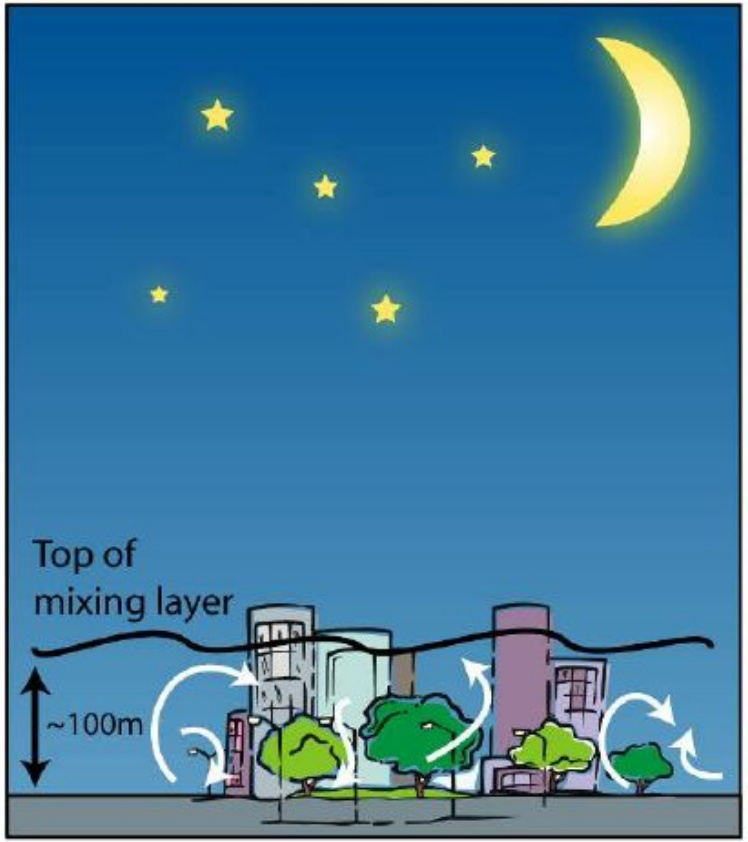
abc



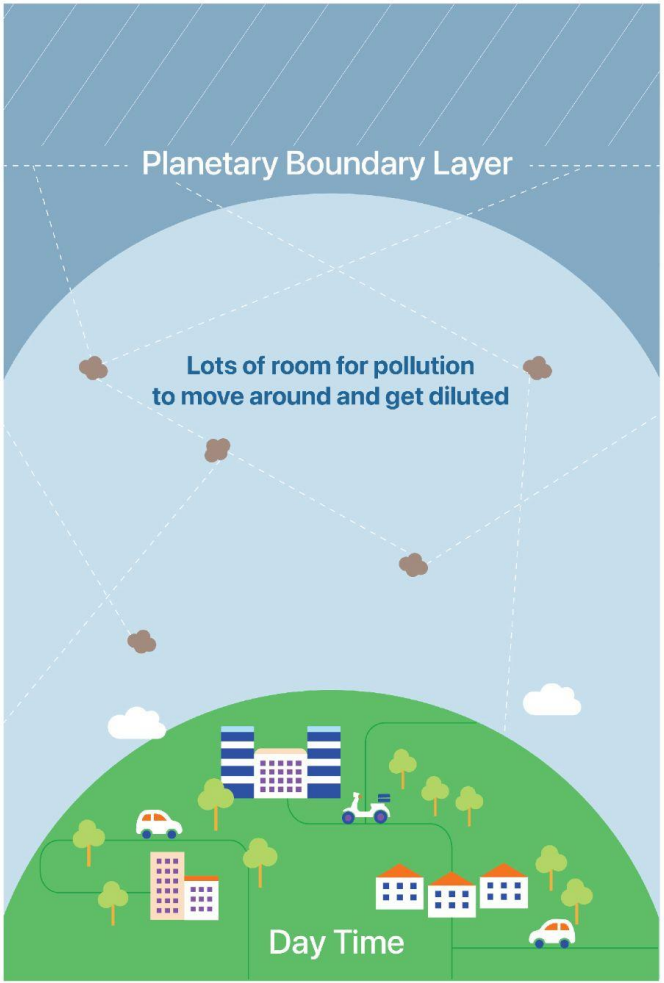

The concentration of our air pollution is related to our atmosphere, more specifically to **Planetary Boundary Layer**



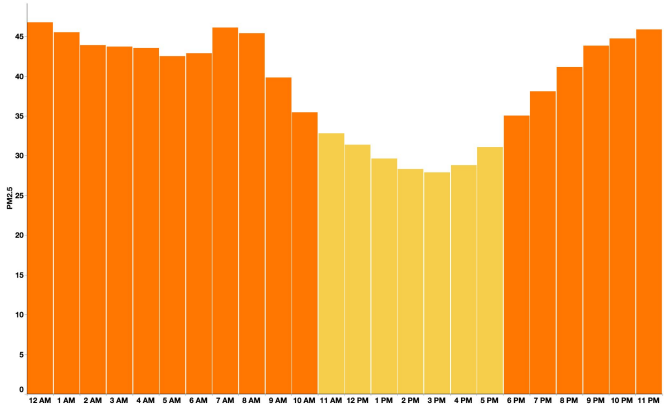

Midday
High Earth Surface Temperature
High PBL



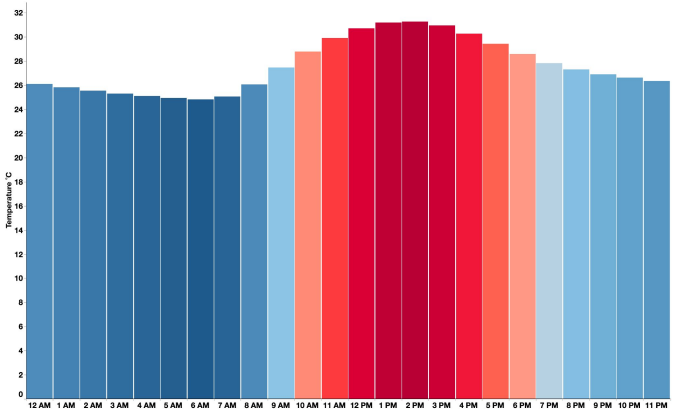

Evening
Low Earth Surface Temperature
Low PBL



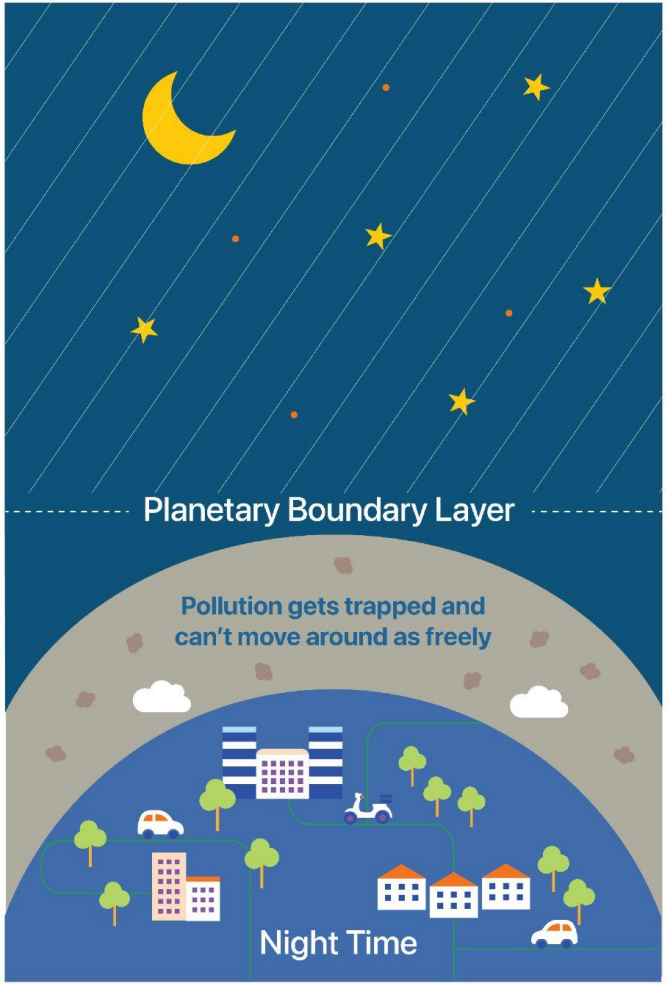

## 24 Hours PM2.5



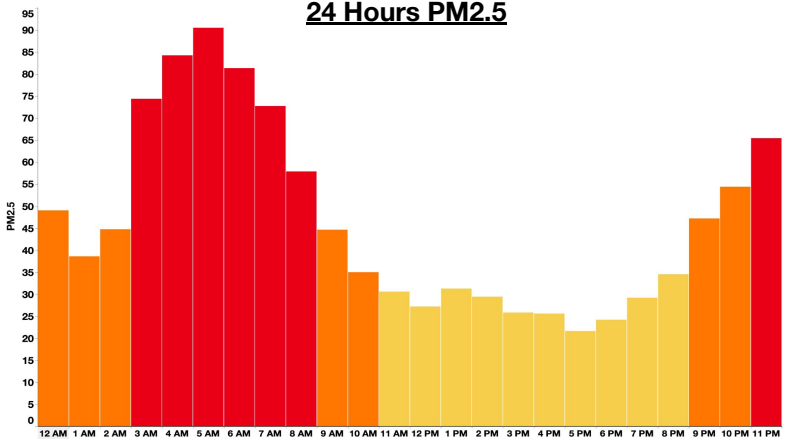

## 24 Hours Temperature



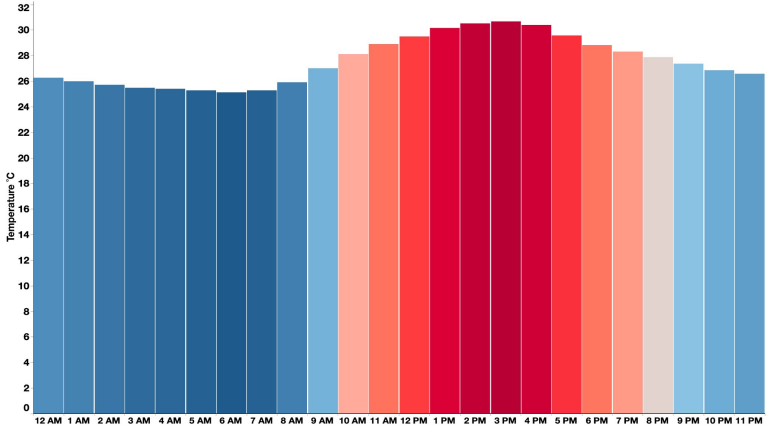

*Source: Nafas, Jabodetabek, May 2022*



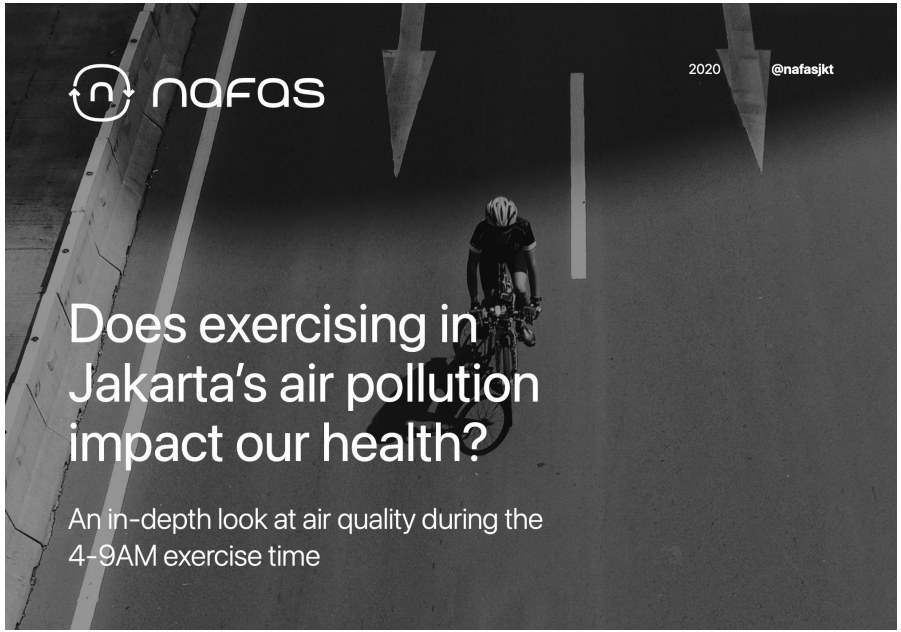

## 24 Hours PM2.5




## 24 Hours Temperature




*Source: Nafas, Menteng Imam Bonjol, May 2022*




*Note: report published by Nafas' data team, taken from a peer-reviewed study from Seoul National University and Cambridge University*

# 33%

# increased risk of heart disease

For people ages 30-45 who exercise every day when the **PM2.5 > 26 g/m3.**

©2022 Nafas, All rights reserved

# In May 2022, the average PM2.5 pollution in the morning can be more than 2-3x above 26 g/m3

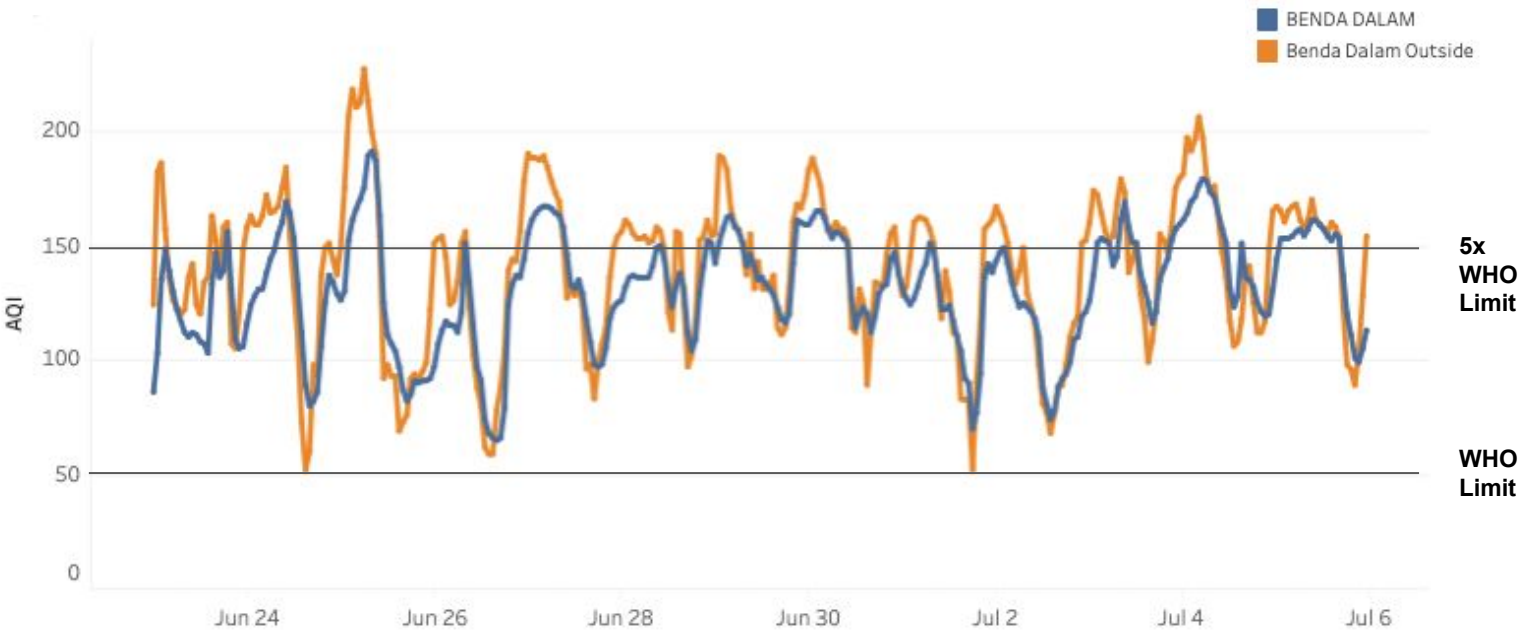
| | North Jakarta | East Jakarta | South Jakarta | West Jakarta | Central Jakarta | Bali | Bandung | Bandung Barat | Bekasi | Bogor | Depok | DI Yogyakarta | South Tangerang | Surabaya | Tangerang |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 AM | 39.7 | 53.4 | 41.2 | 41.1 | 38.5 | 19.5 | 49.3 | 42.5 | 49.6 | 36.8 | 40.1 | 41.5 | 47.5 | 37.2 | 43.9 |
| 6 AM | 40.9 | 54.8 | 40.3 | 41.5 | 39.1 | 25.1 | 53.9 | 46.5 | 50.8 | 37.9 | 40.8 | 47.0 | 48.1 | 38.6 | 43.9 |
| 7 AM | 42.4 | 58.6 | 42.0 | 42.5 | 39.5 | 29.0 | 62.5 | 48.0 | 57.6 | 44.9 | 47.1 | 50.2 | 53.3 | 35.3 | 46.6 |
| 8 AM | 40.7 | 57.3 | 41.6 | 42.2 | 38.1 | 21.2 | 60.9 | 45.8 | 54.6 | 46.3 | 48.4 | 45.5 | 51.3 | 26.1 | 45.4 |

*Source: nafas, 2021 Air Quality Data*

# Air Pollution Is Not My Problem Because I'm Always In The House

50
ug/m3
40
ug/m3

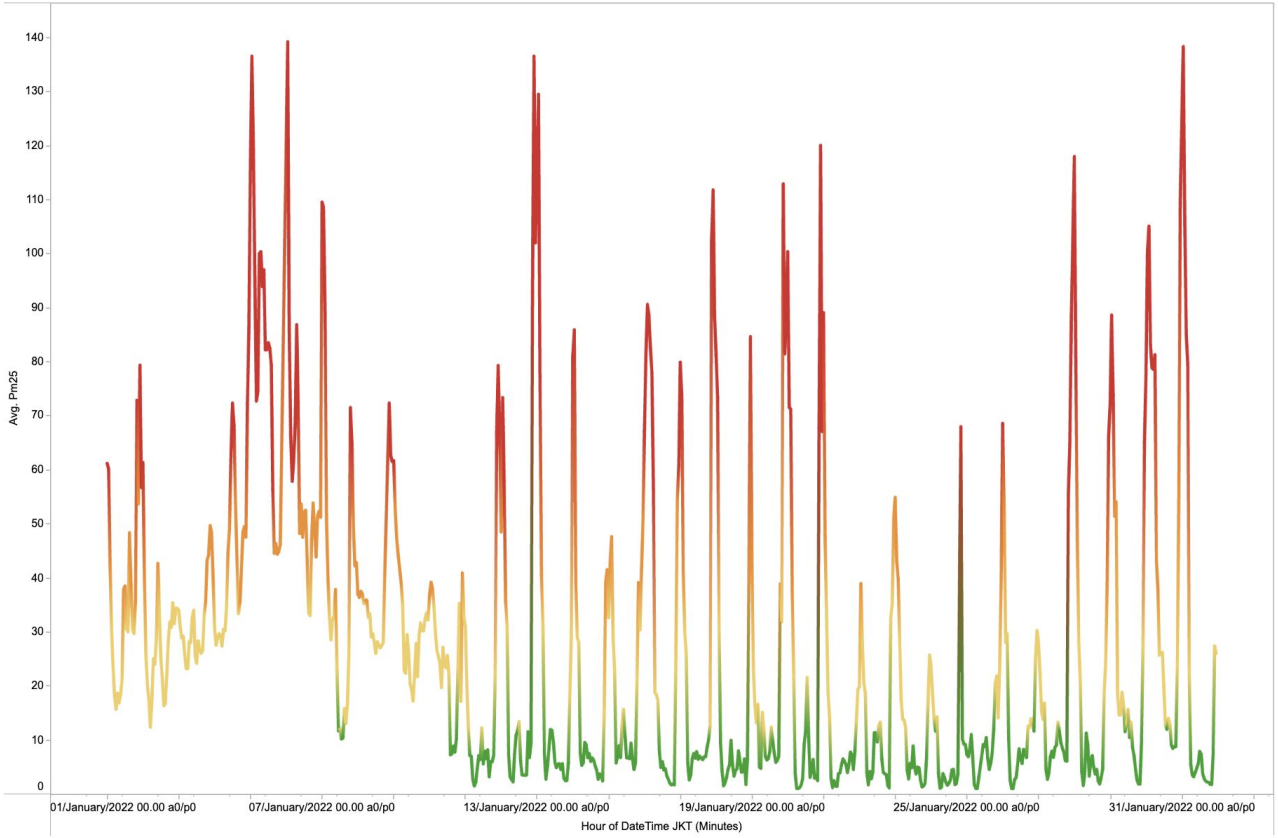
# Air pollution from outside can enter our homes, almost every time.




*Nafas Experiment, June/July 2021*

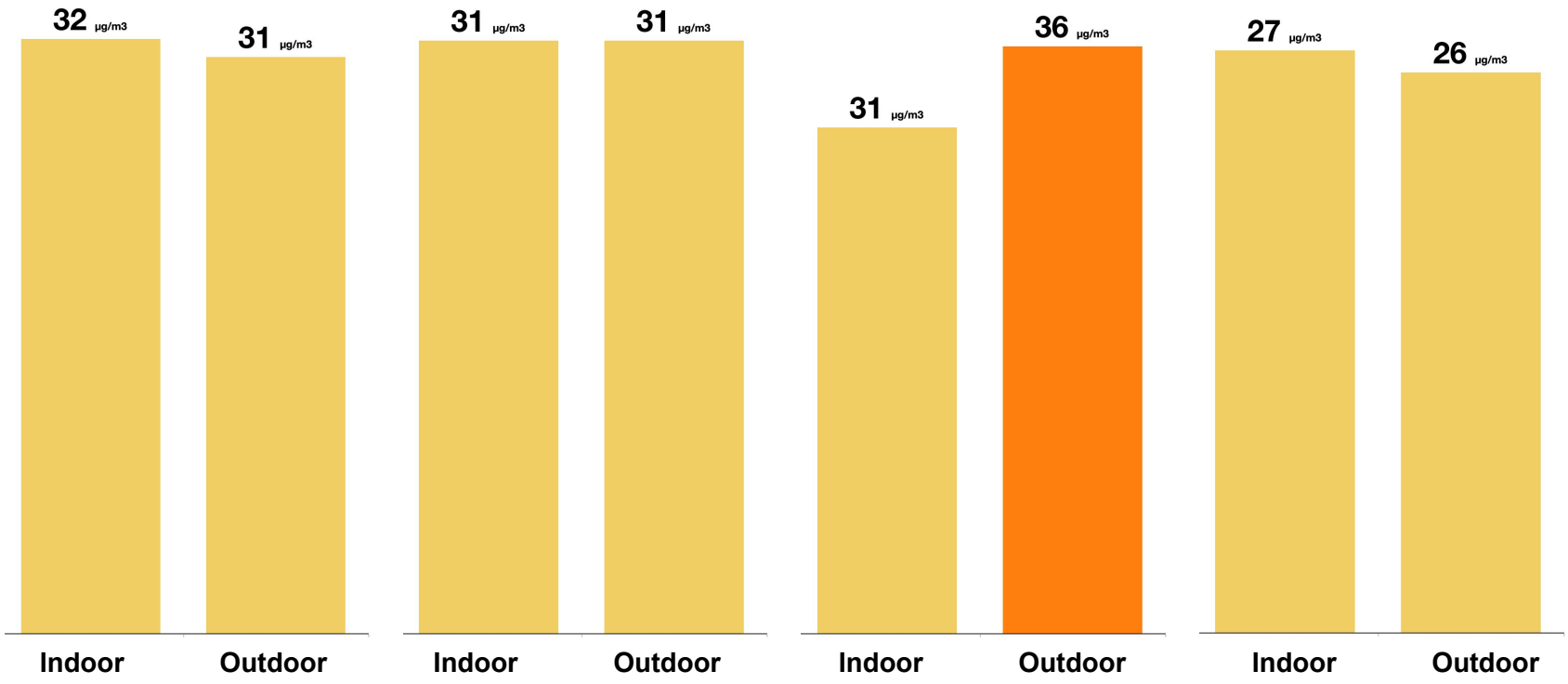
In 2021, Nafas conducted an experiment by recording indoor and outdoor air pollution…

# Indoor air pollution can almost be the same as outdoors.



# PM2.5 that enters the room from outside
# This is the data from 4 kindergarten school buildings in 2 areas in Jabodetabek

R coefficient: 0.8



## PM2.5 that enters the room from outside
## This is the data from 4 kindergarten school buildings in 2 areas in Jabodetabek

### Kemang vs Menteng

| | Outdoor | Studio 1 | Studio 4 | Studio 11 |
|---|---|---|---|---|
| 8 am | **44** | 33 | 31 | 43 |
| 9 am | **39** | 32 | 32 | 42 |
| 10 am | **34** | 30 | 31 | 37 |
| 11 am | **31** | 37 | 29 | 34 |
| 12 pm | **29** | 26 | 26 | 29 |
| 1 pm | **30** | 22 | 24 | 28 |

| | Outdoor | Studio 1 | Studio 5 | Studio 10 |
|---|---|---|---|---|
| 8 am | **30** | 42 | 23 | 28 |
| 9 am | **30** | 40 | 27 | 30 |
| 10 am | **29** | 38 | 23 | 31 |
| 11 am | **27** | 38 | 22 | 32 |
| 12 pm | **27** | 33 | 22 | 29 |
| 1 pm | **25** | 32 | 22 | 29 |

R coefficient: 0.8